MACHINERY.

Vol. 6. August, 1900. No. 12.

A FEW PRINCIPLES OF ORNAMENT.

W. H. Sargent.

In almost every manufacturing establishment there are times when an ornamental design is required and it is not always that a mechanical draftsman can be found who has the necessary taste or the requisite acquaintance with the fundamental principles of design to do justice to the undertaking. There are bases and columns and brackets to be designed, or an ornament may be needed to cover a flat surface; a gate may be ordered formed up out of flat or round rolled iron and the draftsman is apt to feel

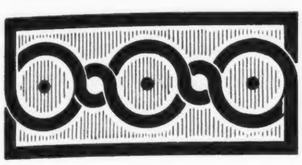


Fig. 1.

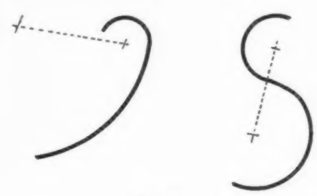


Fig. 2.

that while he can handle straight lines and circles such as come into his daily work, yet he is not capable of attempting free-hand designs. As a matter of fact, the more the work is composed of straight lines and circles, the more it is capable of being regulated by fixed principles. These principles have come down from generations of designers as being necessary to satisfy the eye and gratify the taste in matters ornamental—a sort of hitching post to which the designer must tie his imagination.

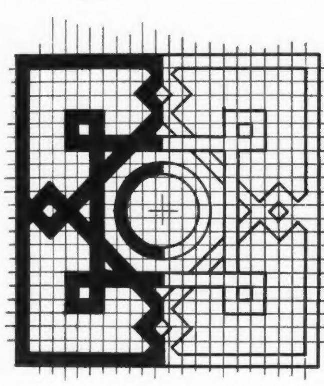


Fig 3.

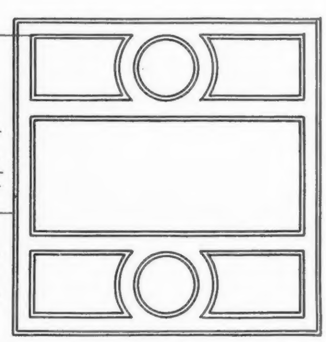


Fig. 4.

The underlying principle of ornament is variety, and the law of contrast or variety leads us to consider the mixture of straight and curved lines as a necessary condition of beauty.

Geometrical designs are produced by arranging and joining lines and dots and repeating or dividing and subdividing in accordance with the laws of symmetry and regularity. The square is the first geometric figure to present itself, the hardest to treat and the least used. While in equity, matters should be

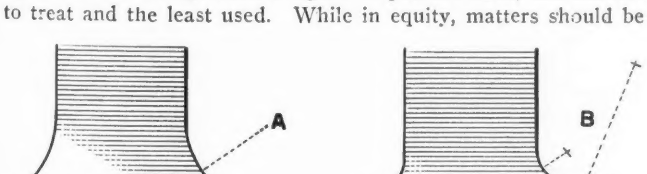


Fig. 5.

"as broad as they are long," this principle will not hold in design. An object should be longer than it is high, as in Fig. 1, or else it should be three to five times taller than it is wide, as in Fig. 6. To treat a square successfully it should be so divided up either by circles or by diagonal lines as to relieve its lack of variety (Fig. 3). By dividing its space into several panels it may be made to appear longer or wider than it really is, as shown in Fig. 4. A picture having the height and width equal is not in pleasing proportion. A cube is subject to the same laws as a square, and should be avoided if possible. A shaper is not so graceful looking a machine as a lathe or an upright drill, since its dimensions are contained within the outlines of a cube, while in the case of the other machines the height and width are unequal. But "handsome is that handsome does," and we overlook appearances because of the obvious utility of the machine. The circle is the most useful fundamental form in

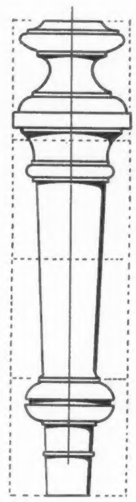
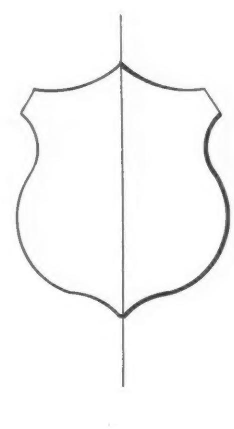


Fig. 6.



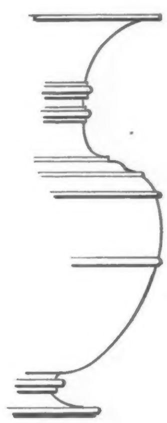


Fig. 7.

ornamentation, not so often alone as in curves which are made up from parts of circles. The most natural subdivisions of a circle are on radial lines and from these, as centers, other intersecting circles may be struck, producing an effect resembling the decoration of watch cases or the elaborate work on bank notes produced by the geometric lathe.

Where the arcs of two circles join together to form a curve, they should not be of the same radius; moreover, the two centers and the point of junction should be in the same straight line, Fig. 2. This is necessary in order to give sufficient variety

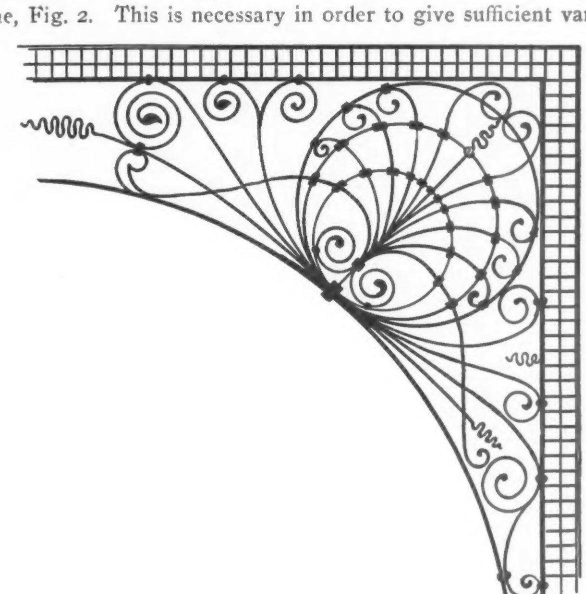


Fig. 8.

to the design, and although we may not always notice it, yet we see it daily. Take the letter S and you will see that the top part is a smaller circle than the lower half. Turn the letter over and the difference at once becomes apparent. An ellipse is to be preferred to a circle because of the greater variety of outline and proportion since it is made up from circles of different radii.

Fig. 5 shows a design for a base suitable, say, for a milling machine. In the sketch marked A the curve is formed by the arc of one circle, while sketch B shows a more graceful curve formed by the arcs of two circles of two different radii. It is a general rule that every long line should be interrupted—a straight line by short curves, a curve by other curves of different radii or by short straight lines, as in Fig. 7. In these days of steel and iron, when the song of the rolling mill is heard throughout the land, the use of wire and rods in decorative work has greatly increased. Wire fencing is turned out by the mile, cheap and substantial, not the ugly barbed variety, but beautiful in design. Wire enclosures for elevator cabs, Fig. 8, are now formed up entirely of that same wire which, in unskilful hands, is so capable of producing commonplace or inartistic effects. This fascinating work is now taught in the schools, where soft annealed wire and round-nosed pliers are used, and as "Venetian Iron Work" it is something of a fad among amateurs. The beautiful gate of the Mills Building, shown in Fig. 9, is a "grown up" example of this work. Just how much decoration to bestow upon metal work would seem to be determined by its purpose and that design is best which best adapts it for the end intended. Do not make up your composition out of short, jerky, disconnected or unrelated fragments like a medley in music. Have some dominant thought, some "motif" which shall bind the different members together. Make first a center line, if the ornament is to be symmetrical and build your design around that. Divide up your space by cross lines which will serve as a guide in laying out the design. Ornament your construction, do not construct your ornament. Have in mind, first of all, the utility of the object, the handiness, and having made the general outlines conform to these conditions, clothe them with as much ornament as your best judgment may direct. Study the catalogues of the manufacturers of ornamental metal work, the stove makers, wire mills, sheet metal pressers, and the designers of locks and door trimmings and builders' hardware—they are an education in themselves. If you wish for a moderate priced book on this subject see Meyer's Handbook of Design. This is published in New York and although I am not authorized to say so, yet I presume it could be obtained through the book department of the INDUSTRIAL PRESS.

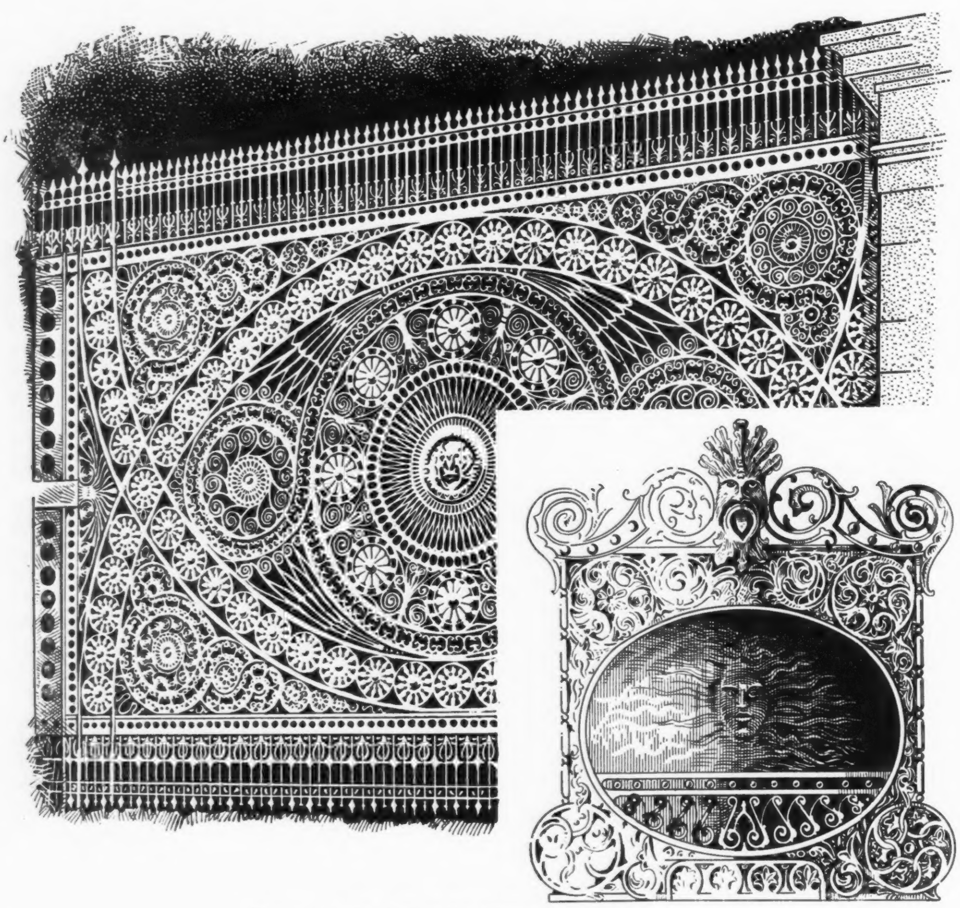


Fig. 9. Metal Gate of the Mills Building, New York.

THE NEW YORK HARBOR FIRE.

Previous to the burning of the wharves and of three of the vessels of the North German Lloyd line at Hoboken, N. J., on the last day of June, it would have seemed inconceivable that so terrible a tragedy could have occurred under such circumstances. The possible destruction of from five to ten million dollars in property and of from 150 to 200 lives, within the space of a few hours, while the vessels containing the fated victims were lying at their docks, was not foreseen by any one. Now that the calamity has happened, however, the causes are very obvious, and, in fact, the conditions were such and are now such at hundreds of other wharves in this country and elsewhere, that it would seem inevitable that just such an event must have transpired in the natural course of things, at some time and some place.

The progress in recent years in the ways and means of keeping fire under control is marked, and nowhere is a better example of this to be found than on board a modern Atlantic liner. The steel hulls and water-tight compartments make it possible to confine any ordinary fire to a limited space, which can be flooded by the pumps in a short space of time.

When the conditions are reversed, however, and the fire comes from above while the would-be fire fighters are below, the very arrangement that ordinarily makes a vessel a place of safety converts it into a veritable death trap. This is what happened at the Hoboken fire. The wharves which, with their buildings, were mere tinder boxes fanned by every breeze that blew, were stored with cotton and other inflammable material; and when from some unknown cause this material ignited, it was but a few moments before the whole was ablaze and the flames had enveloped the frail upperworks of the vessels. The only avenues of escape from the hulls led through the flames above, and those below could not have been confined in a more secure prison.

This tragedy reminds us anew that progress comes through experience only, and often bitter experience, such as this. Nowhere is this fact truer than in engineering in its various branches. It required many years of disaster at sea to teach men to build vessels that could travel from port to port in safety. It was only by the destruction in the Spanish war that naval constructors learned to fully comprehend that battle ships with wooden fittings are more dangerous to their defenders than to those attacking; and now, let us hope that the lives so recently sacrificed will teach the lesson that safeguards are needed to protect lives and property in port as well as on the open sea.

In fact, in port, when engines and machinery are being overhauled and are unavailable for moving the vessel, or even, possibly, for fire protection, and the crew are not on regular duty, extra precautions would seem to be called for. It is now announced that the North German Lloyd will build new wharves, of stone, with fire proof buildings. This is a good beginning for a new order of things, and should lead to many other changes for the safety of life and property.

* * *

Two months ago a fire insurance expert estimated that the losses from fire during the year 1900 would reach the enormous figure of $175,000,000. It now appears that this estimate will be considerably exceeded, as the loss for the first six months was nearly $100,000,000. Such waste is deplorable, as it represents the total destruction of human effort with absolutely no return.

SOME USEFUL RULES FOR THE SHOP.

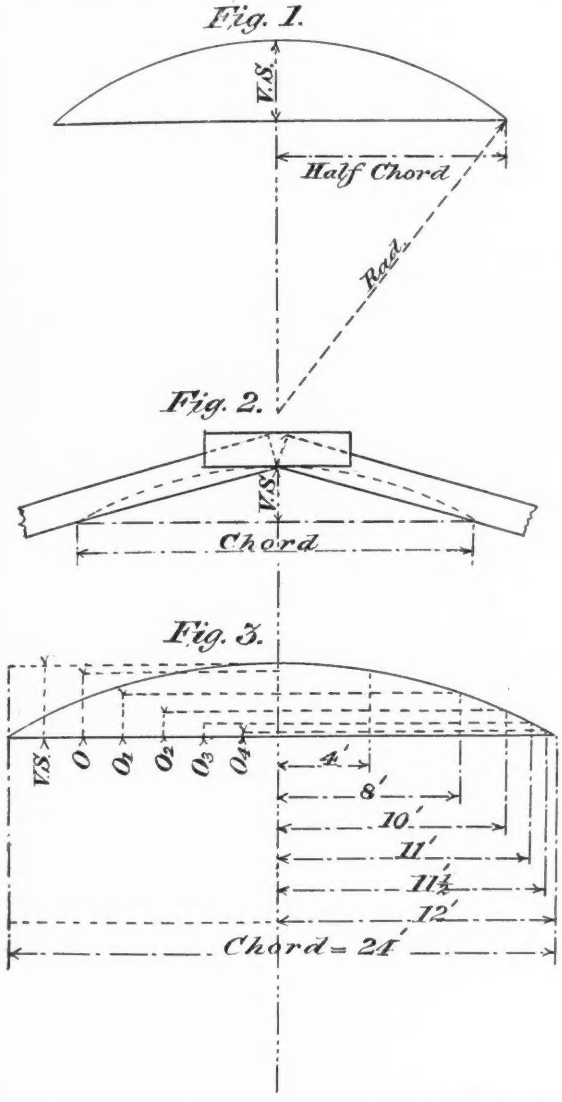
THE PRINCIPLES OF GEOMETRY APPLIED IN PRACTICAL SHOP WORK.

I. McKim Chase

The following problems are frequently met with in the workshops of various trades, especially in pattern making. They are readily solved with the aid of a few figures, and the rules for doing so are easily applied, and require no higher knowledge of mathematics than that of arithmetic.

Probably the problem most frequently encountered is to find the radius of an arc of a circle that will intersect three given points. See Fig. 1. It can be found by the following rule: Divide the square of half the chord by the versed sine, or height, and to the quotient add the versed sine. This sum will then equal the diameter. Example: Let the chord of the arc equal 60 inches and the versed sine 10 inches; required the radius.

Fig. 1. Fig. 2. Fig. 3.



One-half the chord	$60/2 = 30$ inches
The square of half the chord	$30 \times 30 = 900$ inches
Square of half chord divided by versed sine	$900/10 = 90$ inches
Diameter equals	$90 + 10 = 100$ inches
Radius equals	$100/2 = 50$ inches

If it should be found inconvenient to describe the arc with trammels in consequence of the circle being very large or the center inaccessible, it may be described as follows, when the chord of the arc and versed sine are determined: Drive a wire brad at each extremity of the chord and also at the end of the versed sine. Then provide two straight edges; the length of each must not be less than the length of the chord. Let the straight edges bear against the brads at the ends of the chord, and one end of each bear against the brad at the end of the versed sine. In this position secure the straight edges together. Now withdraw the brad at the end of the versed sine and insert a scriber in the apex of the angle formed by the straight edges. By moving the templet to the right and left while bearing against the brads at the ends of the chord, the desired arc will be described. Fig. 2.

When it is inconvenient to describe the arc by either of the foregoing methods, it may be arrived at by laying down the arc to a scale, erecting ordinates from the chord and from the dimensions thus obtained develop to full size. But if greater accuracy is desired than is obtainable by this method, the arc may be determined by computing the length of the ordinates. The chord can be laid down full size, the ordinates erected from it and with the aid of a batten intersecting their extremities, the arc can be described. Fig. 3.

Let the diameter equal 304 feet.

Let the chord equal 24 feet.

In this case the first dimension to be found is the height of the versed sine, which is determined by the following rule: Subtract the square of half the chord from the square of the radius and extract the square root of the difference; subtract this root from the radius and the remainder equals the versed sine. Example:

Radius equals .... $304/2 = 152$ feet

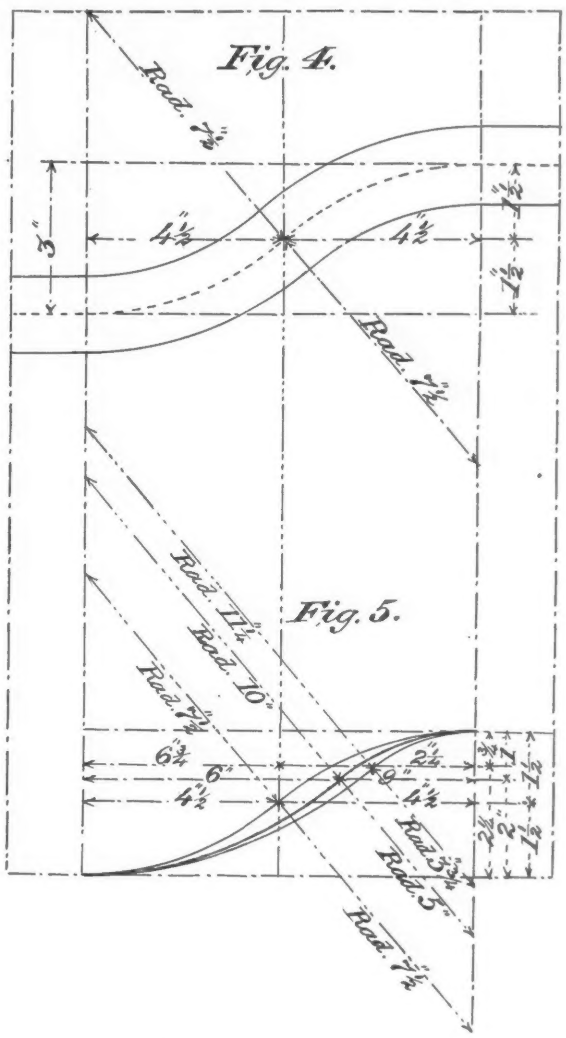
Half chord equals .... $24/2 = 12$ feet.

$152^2 - 12^2 = 23104 - 144 = 22960.$ $\sqrt{22960} = 151.5256.$

Versed sine $= 152 - 151.5256 = .4744$ feet.

The versed sine being determined, the ordinates are found by the following rule: Locate the distance of the ordinates from the versed sine. Subtract the square of this distance from the square of the radius and extract the square root of the difference. Subtract the versed sine from the radius and then subtract this remainder from the root previously found, and the remainder is the required ordinate.

Fig. 4. Fig. 5.



The difference of the versed sine and radius will be a constant in finding all of the ordinates.

As the distance from the versed sine is increased and the end of the chord is approached, accuracy is enhanced by diminishing the distance between the ordinates. Example:

$$\begin{aligned} 152^2 &= 23104 \\ 4^2 &= \underline{\quad 16} \\ \text{Diff.} &= 23088 \end{aligned}$$

$\sqrt{23088} = 151.9473$

$152 - .4744 = 151.5256$

$151.9473 - 151.5256 = .4217$ ordinate.

Similarly the other ordinates are determined.

$\sqrt{152^2 - 8^2} - 151.5256 = .2637 = o_1$

$\sqrt{152^2 - 10^2} - 151.5256 = .1451 = o_2$

$\sqrt{152^2 - 11^2} - 151.5256 = .0758 = o_3$

$\sqrt{152^2 - 11\frac{1}{2}^2} - 151.5256 = .0387 = o_4$

Another problem frequently met with in laying off work is to form an offset; that is, to join two parallel lines with a compound curve either by employing two different radii or a similar radius for both sides.

Fig. 6.

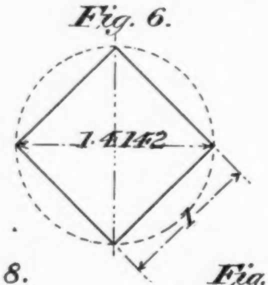


Fig. 8.

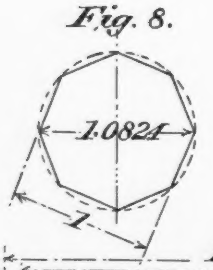
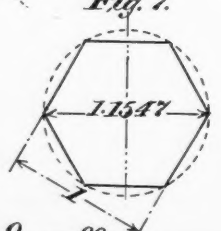
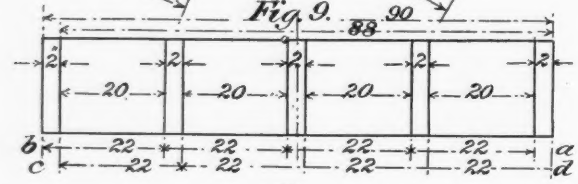
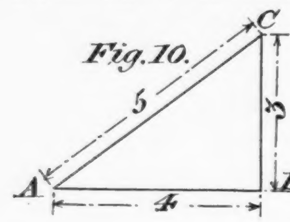
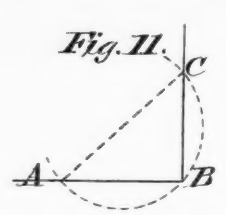


Fig. 7.









Having acquired the rule for computing the radius when the versed sine and chord of the arc are given, it becomes a simple matter for any one to compute the radii for this problem. In Fig. 4 it is required to have a uniform offset of three inches in a length of nine inches. The half chord is one-half of nine, or $4\frac{1}{2}$ inches, and the versed sine is one-half the offset, or $1\frac{1}{2}$ inches. The center line of offset must be joined first, and from the centers thus determined the outside curves are described. By the rule given, Fig. 1, the diameter $= 4.5^2/1.5 + 1.5 = 15$ inches. Radius equals $15/2 = 7\frac{1}{2}$ inches.

There is a peculiarity anent this problem that will repay those who are unacquainted with and who have occasion to solve it to become familiar with. It is that for like offsets the sum of the radii will always be equal, whether two similar or dissimilar radii are employed. For instance, it is shown (Fig. 4) that for an offset of three inches in nine, with similar radii of curvature, the sum of the radii is 15 inches. If it should be desired to have one radius twice as great as the other, it is only necessary to take 2/3 of 15 or 10 for one radius and 1/3 of 15 or 5 for the other (Fig. 5). Or if it is desired to divide into ¾ and ¼, the radius will be respectively $11\frac{1}{4}$ and $3\frac{3}{4}$. This principle is graphically illustrated by Fig. 5.

There are many other such problems as the foregoing that are frequently met with in laying off work, and for the solution of which the cut-and-try method is employed, when by the use of a little arithmetic with a knowledge of the principles involved, a solution could be obtained more readily.

Let it be required to cut a square out of a round stock, as in the case of a nut where a part of the length is cylindrical and a part square, the length of the side of the square only being given. To find the diameter to turn the cylinder, the majority of workmen would lay down the square and measure across the corners; but it can be computed more readily by the following rule: Multiply the length of side by 1.4142 and the product is the distance across the corners, or the diameter of the circumscribing circle. Example: The side of a square is 3 inches; required the diameter of the circumscribing circle.

$3 \times 1.4142 = 4.2426$ inches. See Fig. 6.

If instead of a square, it is desired to find the circumscribing circle of a hexagon use the following rule: Multiply the distance across the sides by 1.1547. Example: The distance across the sides of a hexagon is 3 inches; required the diameter of the circumscribing circle.

$3 \times 1.1547 = 3.4641$ inches. (Fig. 7.)

To find the circumscribing circle of an octagon, multiply the distance across the sides by 1.0824. Example: The distance across the sides of an octagon being 3 inches; required the diameter of the circumscribing circle.

$3 \times 1.0824 = 3.2472$ inches (Fig. 8).

A problem of common occurrence is to divide a given length into a number of equal parts, each part being separated by some object as a rib or bracket. Fig. 9.

The usual way of working out this is to repeatedly try until the desired spacing is accomplished. I have found the following to be a convenient way of arriving at the proper spacing when the ribs are of uniform thickness. From the entire length subtract the thickness of one of the ribs and divide the remainder by the number of spaces, and the quotient will be equal to a space and a rib. With this distance begin at the inside edge of one of the ribs, as at a, and step off, terminating at the outside edge of the rib at the opposite end, as b. Then reverse this operation, beginning at c and terminating at d.

Example: A length of 90 inches, having 5 ribs 2 inches thick, is required to be divided into 4 parts and the ribs to be of equal distance apart.

$90 - 2 = 88$

$88/4 = 22 =$ the distance to step off with.

Of the various methods of constructing right angles without the aid of a square, the two following are the most convenient (Fig. 10). A triangle having its sides 3, 4 and 5 in length or in this proportion has one angle at right angles. Lay off A B equal to a length of 4. With a length of 5 and with one point of the dividers at A describe an arc. With a length of 3 and with one point of the dividers at B, describe another arc at C. Draw right lines from the intersections of the arcs to A and B. The triangle thus formed will have one right angle.

An angle circumscribed by a semi-circle is a right angle (Fig. 11.) Draw the line A, B. Set a pair of dividers to any convenient distance and, with one point above the line, describe a semi-circle intersecting the point B and the line between A and B; draw a line from this last intersection through the center intersecting the opposite side of the semi-circle at C; draw a right line from C to B, and the angle thus formed will be a right angle.

* * *

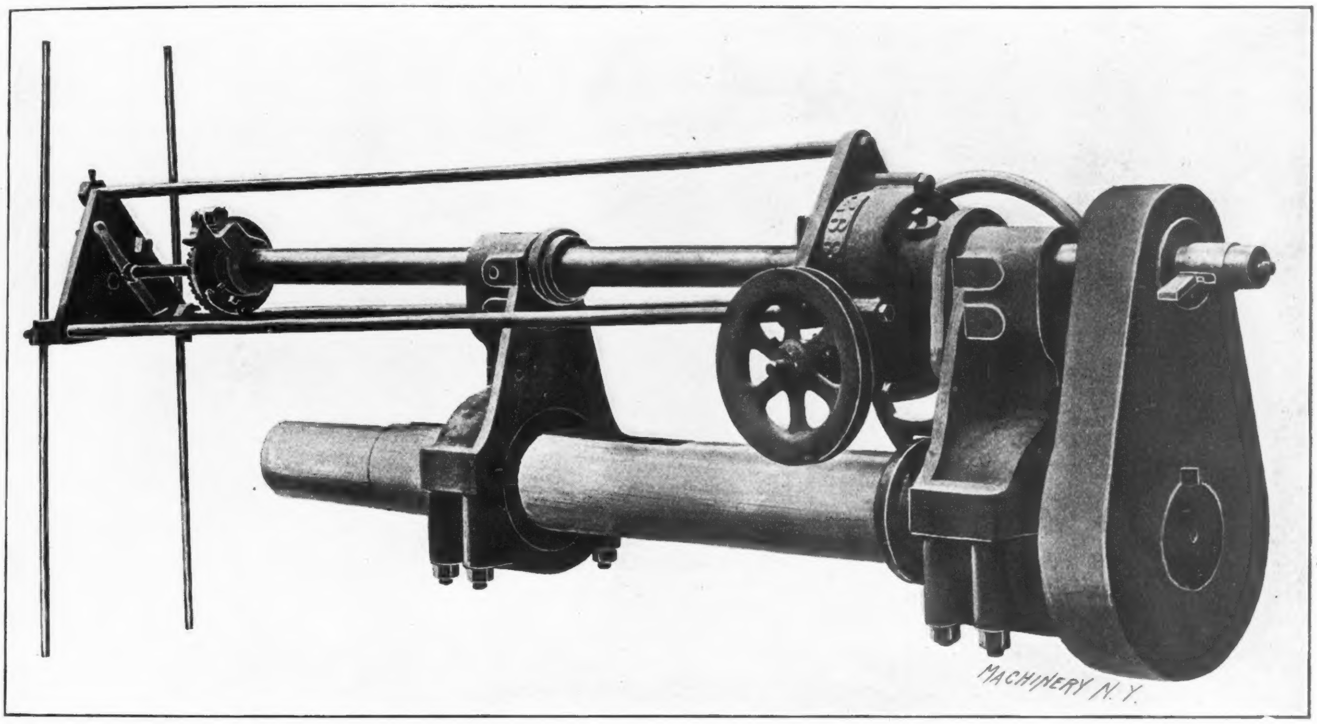
FIXTURE FOR BORING ENGINE CRANKS.

The accompanying illustration is from a photograph taken for our use at the shops of the Lane & Bodley Co., engine builders, Cincinnati, Ohio. It shows a fixture built at these works for boring the crank-pin holes in their engine cranks. Many builders adopt the practice of facing the engine crank and then boring the holes for both the shaft and the crank pin after setting up the crank by this facing on the boring mill table or under the drill press. While this method will bring the two holes parallel and square with the facing, there can be no certainty that they will remain so after the crank has been pressed on the shaft. In fact, in the practice of Lane & Bodley, it has been found that the crank pin would frequently be out of line after the parts were together.

The device shown in the illustration is clamped to the shaft after the crank is in place and the hole is then bored for the pin and faced, insuring parallelism. The boring bar is supported by two arms clamped to the shaft. These arms are bored out large enough to accommodate bushings, which in turn are bored to fit the shaft, thus making the rig adapted to shafts of any diameter. A separate pair of arms is provided for engines of different stroke and the fixture thus serves not only to produce a true

crank-pin hole, but also to bring the center distance between the crank and shaft correct. The bar is driven through a worm and worm wheel by a rope drive, as is plainly indicated. The feed is by a screw and nut operated by a ratchet at the back end of the bar. The screw bears against and is kept from turning by a triangular-shaped piece that is supported by three rods attached to the driving head of the machine, and by two rods resting on the floor. A ratchet wheel is threaded to fit the screw and is free to turn upon the latter; and when it turns, it pushes the bar ahead. The ratchet wheel is operated by a pawl which rotates with the bar and is allowed to drop into contact with the teeth of the wheel, or is raised from contact by a cam which is adjustable and can be set to give any desired feed within its range. This cam is kept from turning by a feather which slides in a spline in the feed screw.

Since adopting this fixture the Lane & Bodley Co. have had uniformly good results and have not had a crank pin come out of line. In this connection it may also be mentioned that they depend entirely upon the press fit to hold the crank pin in place. No nut is used on the pin nor is the pin riveted over at the back. As our readers probably know, there is in vogue at this shop the most complete system of inspecting and recording the sizes of the parts that are to be pressed together, probably in existence. It can be told exactly how many thousandths of an inch was allowed, or rather, actually left, by the workman for forcing, and also how much pressure was required for any part of any engine. With this certain knowledge, therefore, it is believed to be better to depend on no makeshift to hold the crank pin in place, when, if it is forced in sufficiently tight, the friction is ample to hold it securely. It is further believed that if a pin is not forced in properly, it is better to withdraw it and force in a larger one than to try to "make it go" by screwing on a nut at the back.



Machine for boring Cranks in use at the Lane & Bodley Shops, Cincinnati, O.

* * *

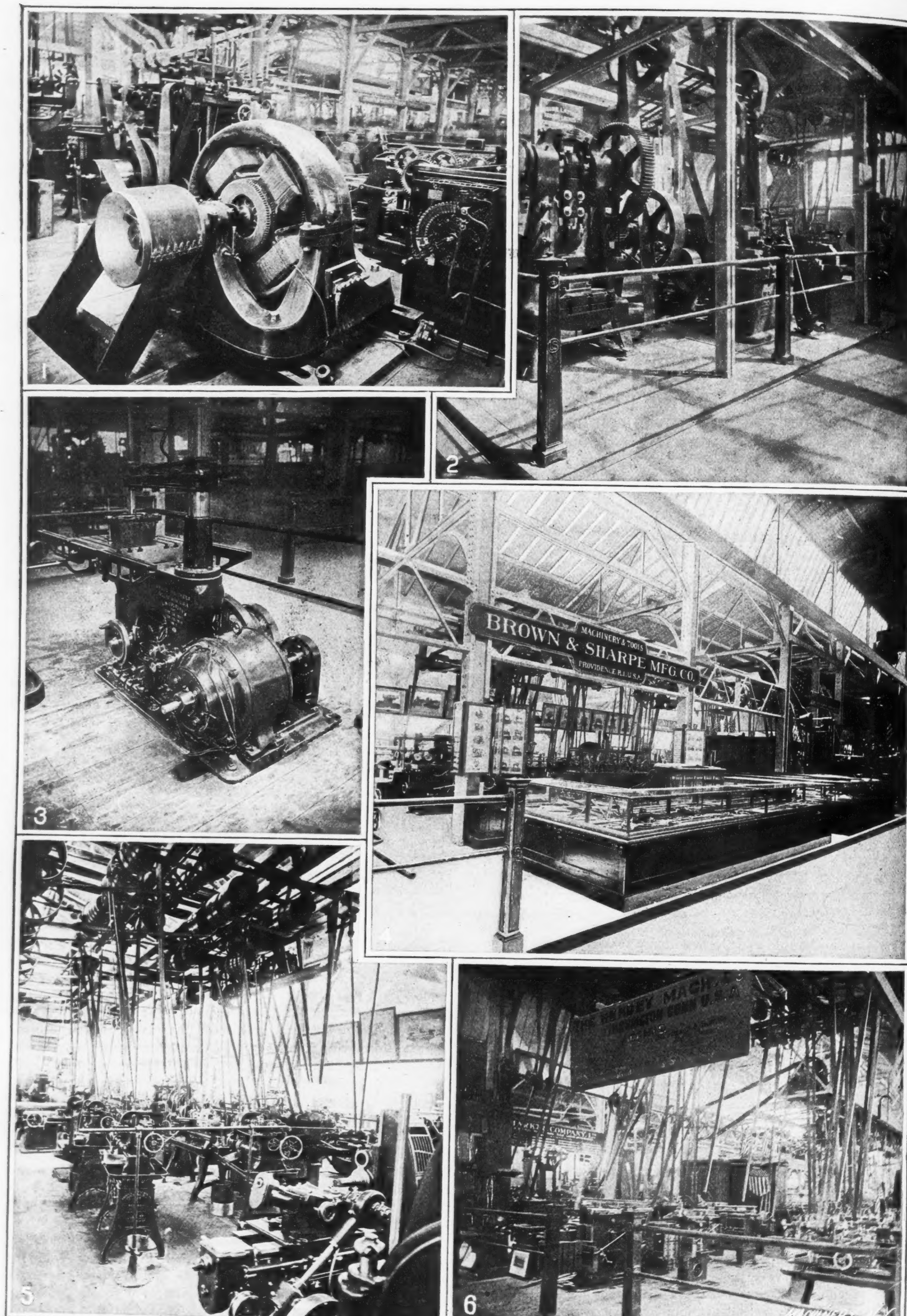
LIQUID AIR.

In a recent number of the Sibley Journal of Engineering Dr. Robert H. Thurston discusses the possible sources of energy for automobiles. Of late liquid air has been urged as a source of power for this and other purposes, and Dr. Thurston expresses his views on the subject as follows:

"It stores comparatively little energy, is enormously costly, especially as a competitor with energy-storage fluids of little or no cost, requires very large quantities per horse power delivered, and no known way exists for its storage for any considerable or satisfactory period, without immense waste. According to Linde—perhaps its most successful, experienced and reliable producer—it requires a hundred horse power at the compressor to produce as many pounds per hour, and it can develop but a fraction, probably a small fraction, of that amount of power in regasifying. It loses by simple vaporization, even in large vessels, ten gallons and upward, about 4 per cent., under the most favorable conditions for its preservation, each hour. Its efficiency in the motor is found to be about 4 per cent.; that of the steam engine is from 7 to 20 and more, and that of the gas engine ranges to still higher figures. In the perfect heat engine the quantity of air required to do the same work within the same range of temperature of operation is about sixteen times as much as of steam; while steam costs nothing as a crude material and liquid air costs no one knows precisely what—probably not less than three or four times, perhaps ten or fifteen times, as much as the fuel used with the steam engine or the gas engine.

"The wild claims of the promoter of the stock companies now in the market for speculative purposes are probably based on but little better reason than those of Keeley or of other mountebanks. Taking its cost in the engine at the advertised minimum, about $8 per ton, and that of steam in the engine at about $0.00025 per lb., about 50 cents a ton, and $4 for coal, the relation is sixteen to one in favor of steam per pound, and many times this per horse power developed. A first-class steamship of 10,000 horse power would probably pay $100,000 for the air alone to operate the proposed system of machinery in a single voyage across the Atlantic. We are, however, still awaiting exact data, and the proposing investor in this field will meantime do well first to ascertain the exact character and records of the men with whom he must deal, their intellectual as well as moral reliability and their standing as scientific men as well as mechanics and mechanical engineers; next to secure by personal observation and measurements, or through a trustworthy and reputable expert in that specialty, precise figures of power expended, product secured and costs of power and product, and, finally, its availability as shown, not through prophecy but by actual experimental and life-size work, for the particular purpose in view. It is always perfectly practicable to ascertain just what the business side of the proposition may be expected to be worth through a careful and accurate investigation, by properly conducted experiments, by well known and reliable methods familiar to every member of the engineering profession.

"The best evidence that the writer has thus far collected indicates that the cost of even refrigeration, in ordinary cold-air work and transportation, as of fruits by train, must be several times as much with liquid air as with ice. The former, costing above sixty times as much as the latter, pound for pound, is capable of far less refrigerating effect per pound. In no ordinary work can liquid air compete with ice or the refrigerating machine.



GROUP OF AMERICAN EXHIBITS AT PARIS. (See opposite page.)

THE VINCENNES EXHIBITS.

HOW THE AMERICAN MACHINE TOOLS APPEAR AT THE UNITED STATES MACHINERY BUILDING, PARIS EXPOSITION.

WARREN E. WEINSHEIMER.

Although the United States Machinery Building at Vincennes was the only place ready to run on the 14th of April, which was the formal opening of the Exposition, it was not until May 10th that exhibits were sufficiently in place to open this building to the public. Since the 14th of April, the boiler and temporary engine plant have been in regular operation, which made it possible to use the 30-ton Shaw crane to move the heavy machinery. This crane has been of wonderful service in unloading and moving cars and also in installation, and its advantages over the French methods of doing this work by brute force are keenly appreciated by exhibitors and visitors.

The formal opening of the building took place on May 10th, in front of the main entrance on the south facade. Mr. F. E. Drake, director of the departments of machinery and electricity, then turned over the space to the Commissioner General. At this ceremony the United States guards in their regular uniform were present. These guards are stationed in the various buildings, and are supposed to see that nothing is stolen from exhibitors and also to give information to visitors.

The cuts shown here illustrate some of the most interesting exhibits in detail as they appeared June 12th. Let us begin in logical order and, entering the main entrance, walk along the center transverse aisle. Fig. 1 shows a line of wood-working machinery made by J. A. Fay & Egan, occupying Block XIV, space 4. Hill, Clarke & Co. and the Springfield Machine Tool Co. occupy the corner, Block XIII, Fig. 2, with multiple drilling machines and engine lathes, respectively. The Mossberg & Granville Mfg. Co. have an exhibit of belt-driven drop hammer presses. They occupy Block XIII, space 6, and are also shown in Fig. 2. Immediately across the aisle, space 4, is an interesting machine of Baker Bros. for cutting keyways in gears, pulleys, etc. It is direct-connected and very compact, as will be seen by Fig. 3.

We have now arrived at Block I and find here a case of L. S. Starrett's tools in space 1. Next to this is the Norton Emery Wheel Co., occupying space 2 and showing a fine line of emery wheels and grinding machines. Space 3 is that of the Leland & Faulconer Mfg. Co. with universal trimming machines. Space 4 shows all the styles of the grinding and polishing machinery of the Builders' Iron Foundry. Space 1, Block II, is occupied by the Gisholt Machine Co., and contains a large exhibit of various-sized universal turret lathes. Space 2 is occupied by hand machinery for pattern makers of the American Machinery Co. Fenwick Freres, one of the largest Paris agents of American machine tools, have spaces 3, 4 and 5 for the vertical drilling machines of the W. F. & J. Barnes Co., while space 6 is an exhibit of oils made by Fiske.

In space 1, Block III, the Prentiss Tool & Supply Co. show simple and multiple drilling machines and an engine lathe. Space 2, Brown & Sharpe's, is one of the largest and most attractive exhibits here. Fig. 4 shows a front view, with the beautiful cases of milling cutters, scales, calipers, gages of all kinds. The case in the rear, slightly taller than the flat ones, contains one of their latest standard measuring machines. It has microscope adjustment on one end and on the other a vernier, from which readings may be taken to 1-10,000 of a millimeter. Some of the samples of work done on the dividing engine machines on polished steel are marvels of accuracy and beauty. The lines are ruled so closely together and the steel is so finely polished that one would think it a mirror reflecting a spectrum from a prism. Fig. 5 shows the rear part of Brown & Sharpe's exhibit, where there are universal milling and grinding machines and automatic turret screw machines, one of which in the foreground is turning collar buttons out of a solid piece of brass and milling "Paris, 1900," on the back entirely automatically. This view also clearly shows how the shafting is arranged. In space 3, ten engine lathes of various sizes and two universal milling machines are exhibited by F. E. Reed. Fig. 6 shows three Hendey lathes and shapers of their newest design located in space 4. One can see the handle for changing the gearing off from the lead screw to the lathe spindle in cutting threads, which is one of the convenient attachments of the Hendey-Norton lathe. Their shapers are too well known to need further comment.

In Block IV, space 1, is occupied by Warner & Swasey, where they are exhibiting five turret lathes for automatic boring and tapping. Their two- and four-spindle milling machines for milling the hexagonal ends of globe and angle valves at the same time are interesting, as is also a novel grinding machine for fitting and grinding plugs in cocks.

Space 2 contains Pratt & Whitney's exhibit. Fig. 7 shows the front and Fig. 8 the back of the exhibit, shafting, belting, pulleys, etc. Their line is quite similar to Brown & Sharpe's, and shows in front two interesting cases of small tools, and on the side and rear the larger machines, such as toolmakers' lathes, centering machines, cup and cone-cutter grinding machines, machines for gun drilling and rifling, hand turret head screw machines, automatic head screw machines, magazine attachments, etc. Spaces 3 and 4 are occupied by the Bullard Machine Tool Co., who have on exhibition three large boring and turning mills and three large turret lathes.

In Block V the Ingersoll-Sergeant Co. have, besides a Corliss engine air compressor, a number of their tripod rock drills, one traveling steam drill and a simple engine air compressor. The H. B. Smith Machine Co. devote Block VI to large wood-working machinery, five planers, two circular saws, and one band saw. In Block VII, spaces 1 and 6, is the exhibit of Simonds Mfg. Co. Space 2 is the office of the director; space 3 contains an interesting direct-connected milling planer manufactured by the Ingersoll Milling Machine Co., and shown in Fig. 9. In space 4, the Acme Machinery Co. exhibit their automatic bolt headers.

Space 1, in Block VIII, is devoted to the exhibits of the Standard Pneumatic Tool Co.; 2, to the Becker-Brainard Milling Machine Co.'s vertical milling machines; 3 is occupied by Flather &Co.; 4, by the Cincinnati Milling Machine Co.; and 5, by the Ferracute Machine Co.

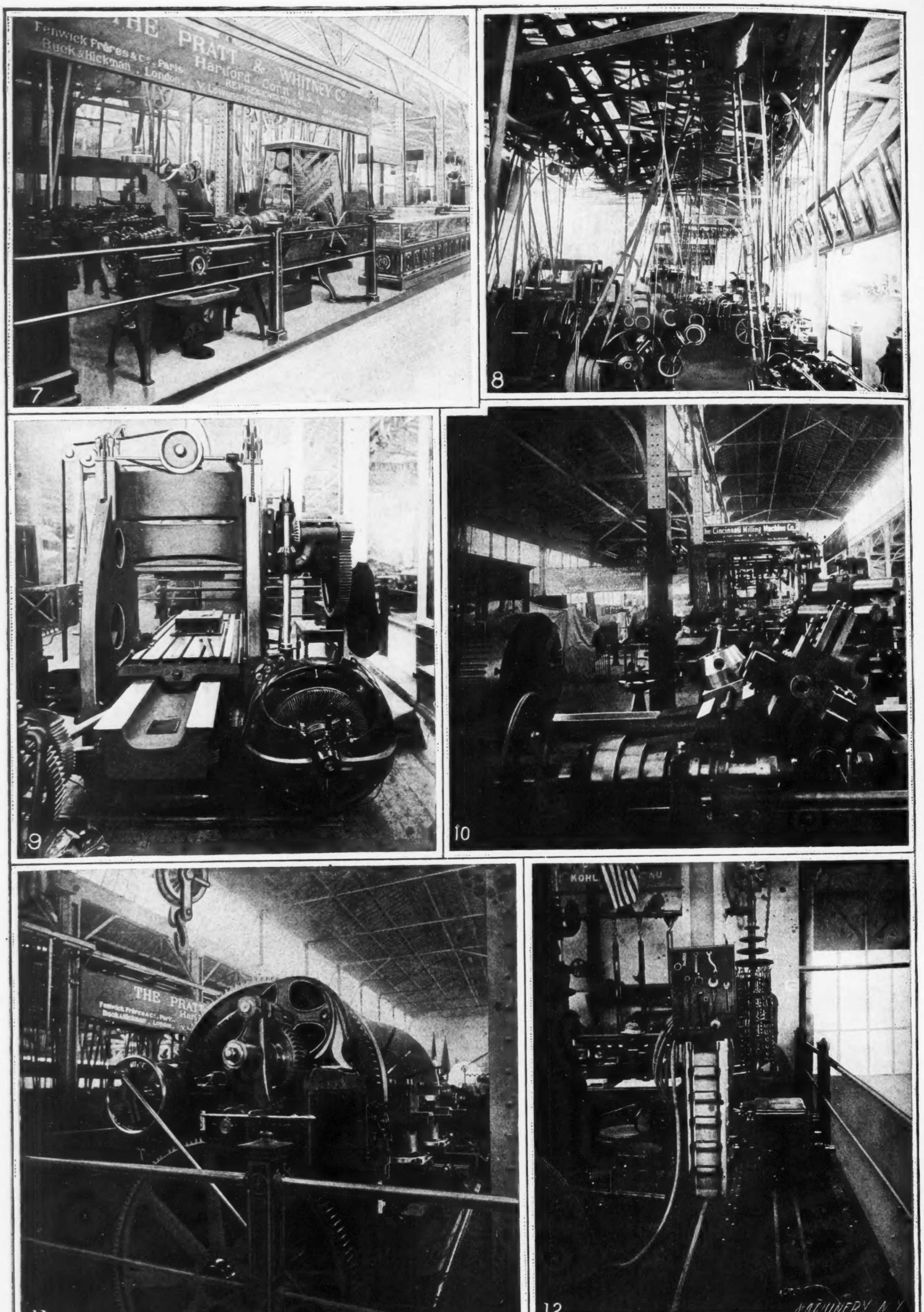
Block IX, space 2, is occupied by the Chicago Pneumatic Tool Co. and by Markt & Co., who represent a number of firms. Among the exhibits here installed are a Mietz & Weiss gas engine direct-connected to a Lundell dynamo; Osterlein Machine Co.'s universal milling machine, and Grant Tool Works' vertical drilling machine. Fig. 10 is a view of the turret on the large Conradson lathe. Space 3 is occupied by Adolph Janssens, with a collective exhibit; Potter & Johnston Co. have one milling machine; Perry Ransom, a double grinding machine; the Westcott Chuck Co., a pyramid of chucks which can be partially seen in Fig. 10. Space 4, the American Tool & Machine Co., and 5, the Landis Tool Co.

The Niles-Bement-Pond Co. occupy the whole of Block X with very large machinery. There is a large boring machine, engine lathe and plâner belonging to Pond. The Niles Co. show two large vertical boring machines, two large lathes for turning locomotive driving wheels. The larger of these is shown in Fig. 11. Fig. 12 shows a coal mining machine exhibited by the Jeffrey Mfg. Co., in space 2, Block XI. Space 1, Block XI, is occupied by the Rand Drill Co., with a Corliss engine air compressor and six drills.

Space 1, Block XII, contains the exhibits of pneumatic tools, saw-cutters for metal, riveting punches, engine lathes, turret lathes and milling machines of the Q. & C. Co. Gould & Eberhardt have a gear-cutting machine for spur gears in space 2. In space 3 are the milling machines of R. K. LeBlond. The Vacuum Oil Co. have their exhibit in space 4, and spaces 5 and 6 are occupied by the Fellows Gear Shaper Co. and the Jones & Lamson Machine Co., with the Fellows gear shaper and machine screw turret lathes, respectively.

In Block XIV, spaces 1, 5, and 6, Sussfeld Lorsch & Co., Paris agents, show the Morgan Machine Co.'s box making and nailing machines, and a full line of saws and saw-sharpening and saw-making machinery made by Baldwin, Tuthill & Bolton. Space 2 contains five large stamping machines built by the E. W. Bliss Co., and in space 3 is an exhibit of De Fries & Co., Paris agents.

As will be noticed, the distribution of the machinery has been made to give the effect of being an ordinary machine shop on a large and varied scale. The exhibitors, no doubt, feel repaid for their efforts, as this building is the most interesting exhibit of the Exposition in this group.



GROUP OF AMERICAN EXHIBITS AT PARIS. (See preceding page.)

MACHINE TOOLS, THEIR CONSTRUCTION AND MANIPULATION.—10.

PLANING MACHINES.

W. H. Van Dervoort.

The planer and shaper, with their modifications the slotting machine and key-seater, constitute a distinct class of machine tools, the office of which is to machine plane and irregular surfaces that can be most readily machined by a straight-line cut. Although a considerable amount of work that, until a few years ago, was classed as planer and shaper work has been turned over to the milling machine, there still remains a very wide

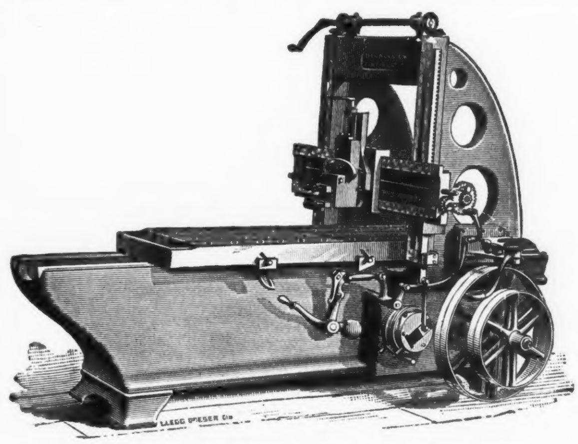


Fig. 87. G. A. Gray Planer, Illustrating Modern Type.

range of work that must continue as planer and shaper work. These tools bear to the machining of plane surfaces practically the same relationship that the lathe does to the machining of round work. The cutting tools used on the planer and shaper are practically the same as those used on the lathe, and the general principles involved in the operating of the machines are quite similar.

The planer and shaper, although used on the same class of work, differ materially in design. In the planer the work moves to the tool, while with the shaper the tool moves over the work. In the planer the vertical and lateral feeds are given to the tool, while on the shaper the lateral feed is usually given to the work, the vertical feed, however, being given to the tool. In what is known as the traverse head shaper, both feeds are given to the tool and the work is held perfectly stationary.

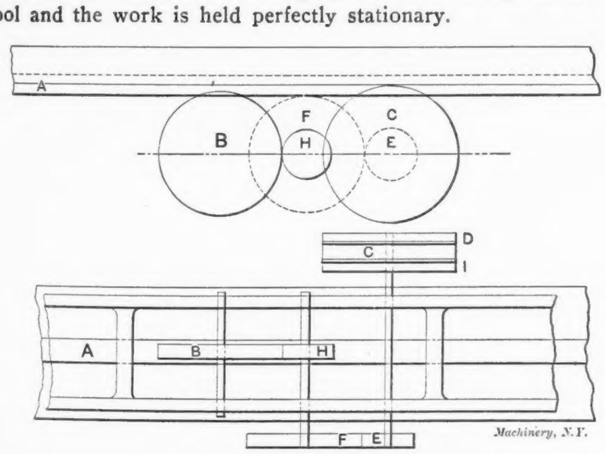


Fig. 88. Table Driving Mechanism.

In Fig. 87 is shown a standard modern planer. The bed is deep and heavy with the work table moving in inverted vees. The housings or uprights are secured firmly to the bed and cross-tied at the top. The cross rail is gibbed to the front of the housings and carries the tool head. The cross rail is adjustable vertically, being operated by the two elevating screws by hand on the smaller machines and by power on the larger ones, as shown in the figure. On the large machines, two heads are frequently used on the cross rail and one on the face of each housing, thus enabling several cuts to be taken on the work at the same time.

The important features of the planer are its table driving mechanism including reversing gear and the mechanism for operating the feeds. In some of the earlier planers the table was driven by a quick-pitch screw with suitable gears and pulleys at the end of the bed. This method has been entirely replaced by the rack and gear drive and the Sellers or spiral gear drive. In Fig. 88 is shown the gear arrangement as commonly used in the rack and gear drive. The rack A is secured to the bottom of the table. The gear B meshes with the rack and is driven from the pulley C through the gear reductions E F and B H. D and I are loose pulleys carrying belts that run in opposite directions. When the belt running in the direction of the arrow is on the pulley C, the table and work move toward the tool and when the reverse belt is thrown upon C, the table moves the work away from the tool. The backing belt is usually driven at about four times the velocity of the forward belt, thus giving the table what is termed a quick-return motion. The object of this is to get the table and work back and ready for another cut with the least possible loss of time. As applied to the planers by different makers, this mechanism differs somewhat in its arrangement, but in all cases is a simple geared reduction. The reversing mechanism differs materially on the various machines. That used by the Gray Co., on the planer shown in Fig. 87, illustrates one of the simpler methods. As quite clearly shown, the belt-shifting rings are attached to a pair of arms controlled by cams. The dogs, which

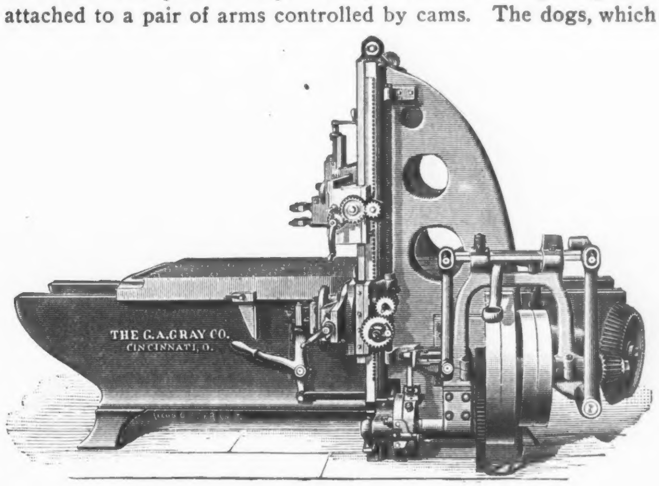


Fig. 89. Planer, with Spiral Gear Drive.

clamp to the side of the table at any point in its length, engage the shipper lever on forward and return strokes, through the connecting rod, and move the cam plate and belt arms. The motion is such as to cause the belt driving to be shifted from the tight pulley before the other belt is shifted on, thus preventing both belts from getting on to the tight pulley at the same time. As these belts must be shifted very quickly and, when the table is making short strokes, very often, it is quite necessary that the belts be narrow and run at a high velocity. These belts will not shift properly if run too tight, and should always be of the best grade of double leather belting in order to stand the wear

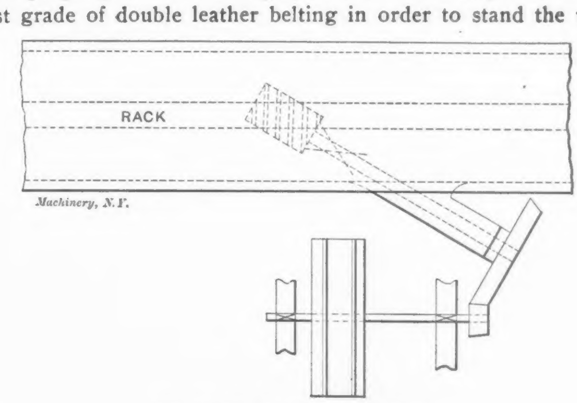


Fig. 90. Spiral Gear Mechanism.

and pressure on the edge. As it is frequently necessary to run the work out from under the tool to make measurements and it is not desirable to change the position of the dogs, the shipper lever is provided with a trip stop which can be raised, to allow the dog to pass over without changing its position. The planer cannot be depended upon to stop its table at exactly the same place each stroke. This variation may arise from changes in the pressure of the cut, but more frequently from changes in the speed of the belts, thus varying the time in which the inertia of the rotating parts is overcome each time the belt is shifted.

In Fig. 89 is illustrated a planer with a spiral-geared or Seller's drive, and the planer shown in Fig. 94 also has a drive of this description.

As shown in Fig. 90, the mechanism for driving the table is quite simple. A spiral pinion, usually having a quadruple thread, engages a rack the teeth of which are at right angles to the length of the table. This throws the axis of rotation of the

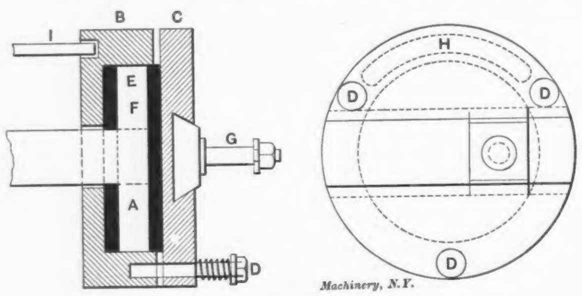


Fig. 91. Friction Feed Mechanism.

pinion away from the line of motion of the table an amount equal to the spiral angle of the teeth in the pinion and carries the pinion shaft at this angle through the side of the bed. This gives a broad bearing between the teeth of the pinion and rack and causes the line of pressure to come directly in the line of the table's motion. Suitable bevel gearing and tight and loose pulleys on the outer end of the shaft completes the driving mechanism. This drive is noted for its smoothness of action, and freeness from the vibration frequently found in spur gear drives.

The mechanism for operating the feeds is comparatively simple on most planers, the same mechanism usually operating both vertical and cross feeds on the cross rail head, or heads when more than one are used. As the amount of feed adjustment per stroke must be constant and as the length of the stroke varies, it is necessary that the feed-operating device give the full amount of feed adjustment during a relatively small amount of the table's stroke. In fact, the shortest stroke it is possible to have the table make, should give the full feed adjustment for each stroke. In Fig. 87 the arrangement shown is simple and effective and in modified forms is largely used by the different builders. The head which operates the feed rack is driven by the extended pinion shaft, the arrangement of parts being as shown in Fig. 91. The disc A is secured to the shaft and consequently rotates with the pinion, right- or left-hand rotation depending upon the direction in which the table is moving. The disc carries a casting B and cover C, the cover being held to B with the three studs D D D and against the friction washers E and F with a uniform pressure by the spiral springs under the nuts on the studs. If the casing is relieved, it and the cover C, together with the wrist pin G, rotate until the casing is again held. In the back of the casing is a slot H into which the stationary pin I extends. The length of this slot is determined by the amount of casing rotation required. In action, the table starts on its stroke, B and G rotate until I strikes the end of the slot H and the rack has been moved up or down, depending upon which side of the center the pin G is on. As the table continues its stroke, the disc A slips between the washers E and F, and G remains stationary. When the table starts on its return stroke, A rotates in the opposite direction, carrying with it B and G until the pin strikes the other end of the slot, the rack having received motion in the opposite direction to that given on the forward stroke. Thus the rack is moved up and down once each time the table moves forward and back, and the amount of the rack motion depends upon the distance G is from the center and is independent of the length of the table stroke. A pinion gears with the rack and through a shaft carries the gear A, Fig. 92. Gear B rotates free on the shaft, gears with C and on its face carries the double pawl D. If the lower foot of this pawl, as it stands in the cut, is thrown in, it slips on the up stroke of the rack, but drives the gear B in the direction of the arrow on the down stroke. If the upper foot is thrown in, it slips on the down stroke and carries gear B in the opposite direction, the direction of feed being reversed. It is evident that with the wrist pin G, Fig. 91, on the same side of the center, the feed occurs at the beginning of the forward stroke when the feed is in one direction and reversal of the feed makes it occur at the beginning of the return stroke. The wear on the feed mechanism is least when the feed occurs at the beginning of the return stroke, as it is not then necessary to move the tool while cutting. On the other hand, feeding on the return stroke makes the wear on the tool in dragging back somewhat greater. When side heads are attached to the face of the housings, they are given a vertical feed on the housing in a manner similar to that already described. By removing the gear C from the cross screw and putting it on the feed rod, the vertical feed is operated in a manner similar to that for the horizontal feed.

The size of a planer is determined by the length of its table, the distance between housings and the maximum distance between table and bottom of cross rail. What is known as the extension side planer is shown in Fig. 93. In this tool, the capacity is increased by spreading the housings, an extra long cross rail, of course, being required. This class of planer is of value in shops where only a small per cent. of the work done requires a wide planer. Another modification known as the open-side planer is shown in Fig. 94. In this tool one housing is dispensed with entirely. The cross rail being heavy, strongly

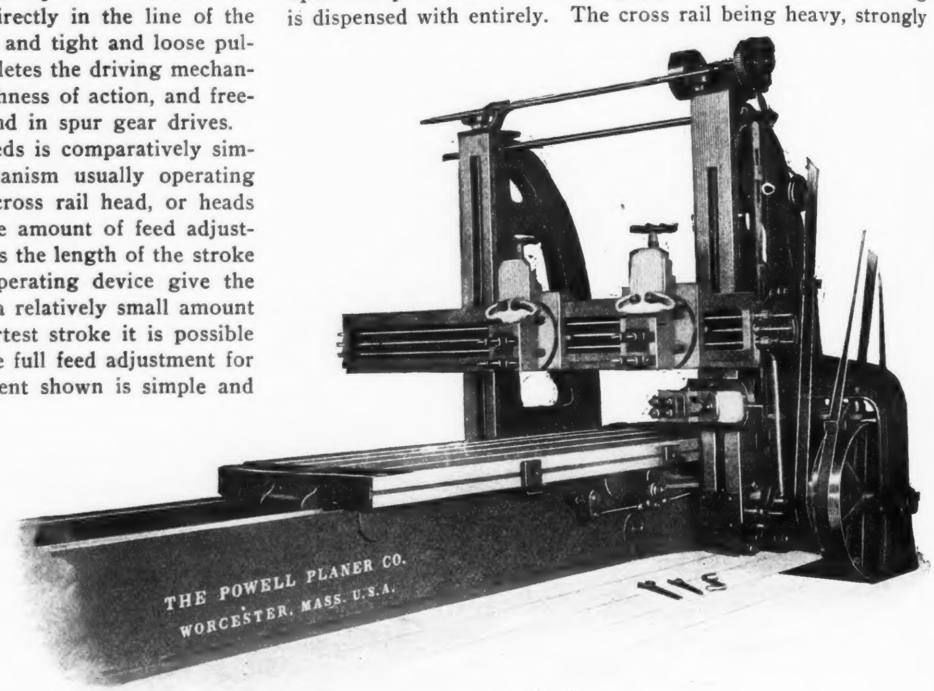
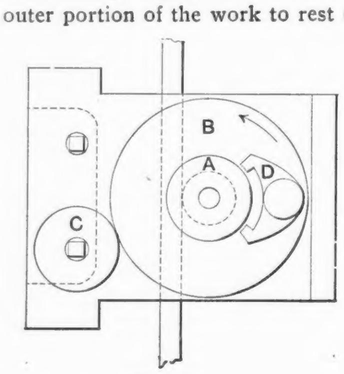


Fig. 93. Woodward & Powell Extension Planer.

braced and carried on heavy housings on the one side, removes the width limit on the work to be machined. When the work is very wide and overhangs the table by an excessive amount, it is necessary to provide some form of out-board support for the outer portion of the work to rest on.



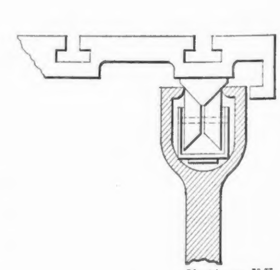


Fig. 92. Fig. 95.

On all planers the cross rail is elevated by two square-thread screws set in the face of the housings and geared together at the top. These screws are preferably right- and left-handed and must be very accurately cut, as otherwise the cross rail will not remain parallel to the table in its width at all positions. On the

larger sizes where the cross rails usually carry two heads and are very heavy, the elevating screws are operated by power belted from the countershaft.

The form of bed shown in Fig. 87 is the one known as the deep box bed and is now quite generally used. It is strongly ribbed and its form is such as to make it very strong and rigid. The form of table guide quite exclusively used on planers is known as the inverted "V." In any planer it is very important that these guides be most carefully fitted and suitable means provided for their lubrication. The bearing surfaces are usually grooved to retain and distribute the oil with suitable wipers provided to carry the lubricant to these surfaces. In Fig. 95 is shown a common and very efficient method. An oil well or pocket is cored in the bed near the center of the table's motion and a pair of conical rollers carried in a suitable frame and held against the surface by a spring, carries the oil from the well to the surface to be lubricated. The principal difficulty with this arrangement comes when the table is worked on short stroke for a considerable length of time, as in that case the portion over the rollers only is properly lubricated. On long strokes, however, the action is perfect.

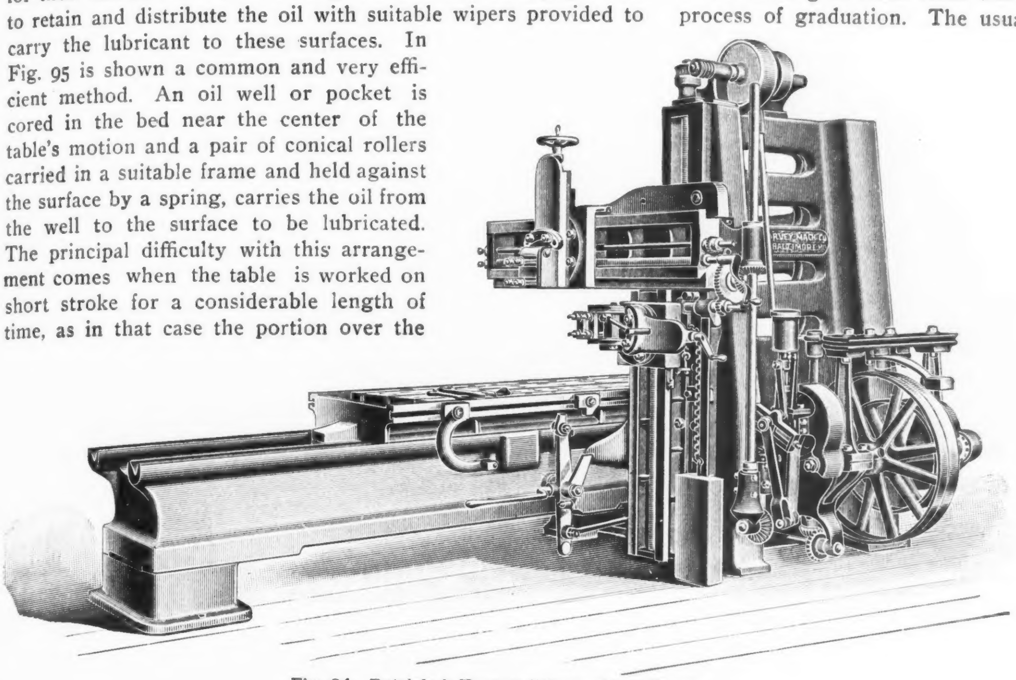


Fig. 94. Detrick & Harvey "Open-side" Planer.

The planer table is always provided with a large number of holes for stops and for bolting the work to the table, also with suitable T-slots. These holes should be drilled and reamed and the T-slots planed or milled in order that the bolt heads may move freely in them.

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AN ACCURATE MACHINE.

The dividing engine that was designed and built by Warner & Swasey, Cleveland, Ohio, for use in connection with their astronomical work is one of the most accurate instruments of precision ever made. It will graduate a circle with a maximum error, probably not exceeding one second of arc, or a distance of one-third of an inch on the circumference of a circle two miles in diameter. It is not desired, however, to state that this is exactly the maximum error; this point will be determined later by U. S. Government experts who have astronomical instruments graduated on this machine. The base of the machine rests on three rubber plugs upon a bed of masonry, which latter is built on a bed of sand. This combination foundation successfully resists all vibration. The work table is a flat circular plate which is supported by a vertical taper spindle. This spindle was lapped to fit a taper bearing in the base, but as the table weighs several hundred pounds, it was necessary to relieve the friction of the bearing and the method employed to do this, as well as to retain the alignment of the table is simple and might easily have other applications. At the lower end of the spindle is a ball thrust bearing, which is pressed against the end of the spindle by weights. The thrust of this bearing is about ten pounds less than the downward thrust of the spindle, due to the weight of the table, and the spindle is therefore seated in its bearing with a pressure of ten pounds. Thus, supposing the table to weigh 500 pounds, 490 pounds of this weight would be carried by the balls and the remaining ten by the taper bearing. This, it is calculated, is sufficient to keep the table accurately in place and yet it turns with ease.

The table is spaced by the usual tangent screw or worm, which meshes in teeth milled in the periphery of the table. Contrary to usual custom, however, these teeth were not first milled and then corrected by a series of approximations. In the first place spaces were ruled upon an annular surface or ring of silver around the edge of the table. By careful microscopic measurements the variation or error from mark to mark was determined and another set of marks was ruled in which the errors of the first set were allowed for. These rulings were then measured and another circle graduated, and so on. Finally, when thought to be sufficiently accurate, the teeth were milled in the periphery of the disc for the worm or tangent screw.

The milling of these teeth was scarcely less difficult than the process of graduation. The usual process of rotating the hob and disc together could not be employed, of course, because there was no accurate means of feeding the disc. The latter must be moved by the aid of the final graduated circle, the distances being determined by microscopes, and it would thus be impossible to move it continuously. The only way was to move it a distance equal to the pitch after each tooth was completed, and to give the hob both a longitudinal and rotary motion as though it were a screw traveling along the edge of the disc. This produces the same relative effect as though the hob rotated, merely, and the wheel turned as though driven by it.

The blank for the hob is a tool-set steel screw lapped until practically perfect by the process used by Prof. Rowland in producing the screw of his famous dividing engine. Teeth were cut in one end of the screw, making a hob of it, and the other end worked in a nut and fed the hob longitudinally as the screw and hob rotated. The lapping was done after hardening to eliminate shrinking errors.

We trust that at some future time Messrs. Warner & Swasey will favor the mechanical public with a complete description of this extremely interesting machine.

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An interesting feature of the immense foundry connected with the General Electric Works at Schenectady, are the portable jib cranes for serving the moulding floor. The foundry is served by a number of traveling cranes, but for a great deal of the local work in such a large establishment it is cheaper and more convenient to handle much of the smaller work by jib cranes. To facilitate the use of these cranes and yet prevent such a multiplicity of them as to interfere with the open space, the frames of the jib cranes are arranged with hinges similar to that of an ordinary gate. Similar hinges are provided on the supporting posts throughout the length of the main aisle, and whenever a jib crane is wanted at any particular spot, it is transported to it by the traveling crane and hooked in place. Thus a small number of the jib cranes are made to cover the entire area of the foundry floor and are made instantly available wherever needed.

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By the introduction of a form of induction coil in a submarine cable at certain distances apart, Prof. Pupin, of Columbia University, has demonstrated that long-distance submarine telephony may soon be a commercial possibility. With an experimental cable line 250 miles long operating under practically the same conditions as exist with a submerged cable, conversation was distinctly audible, a fact that is of considerable importance when it is known that 40 miles of cable is the limit of submarine telephony at present. The discovery it is thought will not only increase the range of submarine telephony, but also greatly augment the commercial radius of aerial lines. Submarine telegraphy can also be facilitated by its use, as then it will probably be possible to use the quadruplex system and thereby increase the capacity of the cable four times.

NOTES ON THE TRANSMISSION OF POWER.

STEP BEARINGS, VERTICAL SHAFTS AND COUPLINGS.

An article appeared in the July, 1899, issue of MACHINERY on "Step Bearings" in which were shown a number of forms of this somewhat unsatisfactory form of bearing which had given various degrees of success. The proper construction of a step bearing is an important feature in machine design and the failure to observe proper precautions in its design and construction has often been the cause of considerable trouble. The trouble with the step bearing is to obtain sufficient area for the pressure so that the load per unit of area will not exceed what has been found to be safe practice. If the load per unit is found too high, it is often of no avail to simply enlarge the diameter of the bearing surface, as by so doing the peripheral speed of the outer portions of the bearing is so much increased that the saving in pressure per unit is more than made up by the increased friction due to greater velocity. Again the wear on the outer portions is greater than near the center, so that a simple step bearing quickly wears to have a bearing only near the center, with the result that heating ensues.

The writer recently had an opportunity to examine a form of thrust or step bearing manufactured by P. Pryibil, New York, which is said to give excellent results. This bearing is made specially for supporting vertical shafts in establishments where power is to be transmitted to upper floors and it is desirable to avoid cutting belt holes through the floors. The advantages of this method of power of transmission to upper floors are worth consideration. The loss from friction is said to be considerably less than where the ordinary belts are used for the purpose and not least, the fire risk is greatly reduced, as belt openings are not required with the vertical shaft.

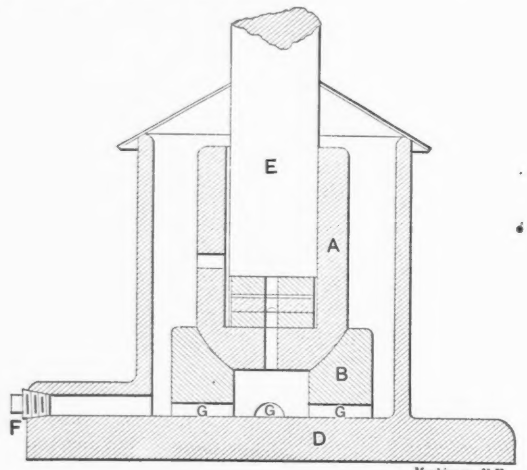

Fig. 1. Step Bearing, showing Oiling Device.

The step bearing referred to is shown in the accompanying sketch, Fig. 1, and will be seen to be quite similar to the ones shown in the article referred to, only that this one has adjustable features which allow it to conform to irregularities in the foundation or lack of alignment of the vertical shaft.

The shaft E is supported by three washers which are contained in the cast-iron cup A. These washers are of hardened steel and phosphor bronze, the middle one being of the latter metal, while the upper and lower washers are of steel. These washers are very accurately made, great pains being taken to have them perfectly flat and of uniform thickness. A hole is provided through the center of each to favor the lubrication of the working surfaces. The cup A has a spherical surface at its lower end which fits in the casting B. The latter being accurately bored to fit the rounded end of A, supports the cup with the shaft, but allows it to take any position within limits necessary for perfect alignment. To allow for variation from exact position, the part B is not secured to the outer shell D, but sets loosely on the bottom and can therefore slide into the correct position. The parts A and B, being of larger diameter than the bearing, do not rotate, as they have much greater frictional resistance. The outer part being filled with oil, the bearing is constantly flooded and the centrifugal action tends to create a circulation through the holes G G G up through the central hole in the washers and out through between their faces. The multiplicity of bearing faces prevents cutting as, when friction between any two opposing faces becomes so great that abrasion begins, the motion between them ceases and takes place between some of the others.

An instance is quoted where this form of bearing is in successful operation in a Connecticut factory in which the vertical height of the shaft is 100 feet with a diameter of the lower section of about 4" and is run at a speed of 160 turns per minute. The total weight on the step due to the shaft, couplings, pulleys and belts is about 4,800 pounds or 380 pounds per square inch of bearing surface. The approved form of belting to the horizontal shafts

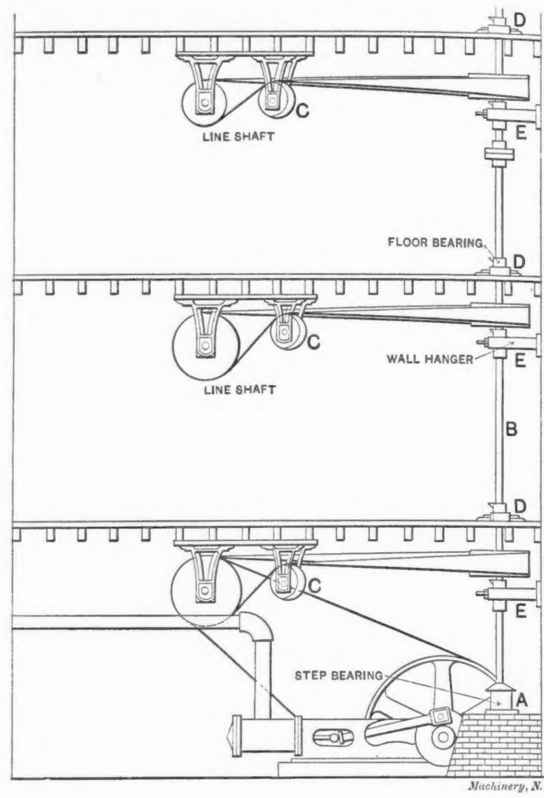

Fig. 2. Transmitting Power by Means of a Vertical Shaft.

on the different floors is that shown in Fig. 2. The belts from the pulleys on the vertical shaft B are carried over a mule pulley or idler C C C. By using the idler or guide pulley, as shown, the usual difficulties with quarter turn belts are avoided. The belt wears longer, as it is not so severely strained along one edge, and it does not run off if the line shaft be turned backwards; and the idler presents an effective means of taking up the slack in the belt, thus making frequent cutting and lacing unnecessary. Of course, in such an installation, the pulleys should be so arranged as to put the idler on the slack side of the belt, as in this position it is more effective and the loss by friction is far less than when oppositely placed. A feature of this form of power transmission, which will often be of value, is that power can be

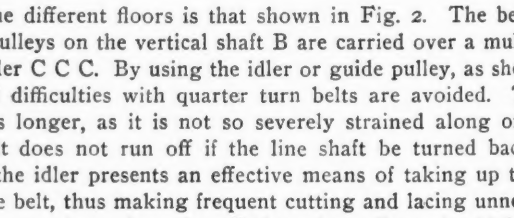

Fig. 3. Clamp Coupling.

transmitted to shafts running at right angles, without complication. If done on the same floor, one pulley will be located high enough to clear the belts from the other, but otherwise the belting will be the same for each.

A form of clamp coupling developed by the same manufacturer is that illustrated in Fig. 3. The coupling has an internal part A and is connected to the rim only on one side. The part A is split on the side opposite to its connection with the exterior and is also

cut in two laterally on one side, as shown at D. The other side is continuous throughout its length. The clamps B B' are dovetailed to fit over the free end of A and are tapered, as are also the edges of A. As the tapered parts of A are opposed, when the two clamps are drawn together by the bolt C, the parts of A are firmly gripped on the shaft. The side of the coupling that is continuous preserves the alignment. This clamp requires keys and keyways the same as the ordinary flange, but has the advantage of being easier to connect or remove and can also be used on shafts having slightly different diameters without necessitating special fitting.

* * *

TODRANK TIOSA AND THE BOSS, OR THE MAN OF FEW WORDS.

Todrank Tiosa was a man who worked in a country machine shop, and lived on his farm, which he owned, and which his father owned before him. He got up at 4 o'clock in the morning to look out for things around the farm, and then drove into the village where the machine shop was situated, and of course drove back to the farm after his day's work in the machine shop was done. This was all right in the summer, but rather a hard job in the winter, but Todrank never complained, being "a man of few words."

Birdseye Birmingham, who was the owner of the shop where Todrank worked, often asked him why he didn't sell his farm

"It was the last straw which induced Todrank Tiosa to . . . . . move into the village."

and move into the village, and held up in glowing terms the advantages which Todrank would reap by such a move. The long, cold drive in the winter would be no more; getting up at 4 o'clock in the morning would be a thing of the past; and, if there happened to be a circus in town, Todrank could go and get home in time to go to bed before starting to work, and when finally

GORMAN'S
EQUINE MARVELS
Moving in
MAJESTIC MARCH
MANOEUVRE
DANCE
and
TABLEAUX
Building Pictures
of
ENTRANCING SPLENDOR
in
SIMULTANEOUS ACCORD

was announced on the bills, it was the last straw which induced Todrank Tiosa to take Birdseye Birmingham's advice, sell his farm, and move into the village.

The farm was a large and valuable one, and Todrank sold it for enough to have a little cash balance left over when he got his house in the village paid for, and he said "nothing to nobody," but went with his cash balance and bought a wood lot.


"But Todrank 'never said a word.'"

Not long after Todrank got settled in the village, Birdseye came around one day and told Todrank that business had not been very good lately, and that it became necessary to reduce Todrank's wages to the extent of about 15 per cent., but Todrank "never said a word" much to Birdseye's surprise.

When Todrank went home from the machine shop that night he stopped on the way and bought an axe.

The next morning he took the axe and started for his wood lot and began to cut wood, still saying nothing.

Birdseye missed Todrank, and was a little surprised, because Todrank was a remarkably steady man, and he kept on missing him every morning for a week, when his curiosity got the better of him, and he called around to see Todrank in the evening.

Todrank was at home and seemed glad to see him, but hadn't much to say as usual.

Finally, Birdseye had to speak right out and ask Todrank where he had been the last week.

"Oh, over in my wood lot," said Todrank.

"Why," said Birdseye, "I didn't know you had a wood lot."

"I did," said Todrank, from which it will be seen that Todrank was a man of few works, as mentioned above.

"Well," said Birdseye, "what I called to say is, that business has improved very much during the last week, and if you will come right back to work, we can manage somehow to pay you the same we have been paying."


"He took his axe and started for the wood lot."

And there have been no more trees cut down on the wood lot since.

It is too bad to cut down all the trees, anyhow.

Greasy Jay.

* * *

While failures are always discouraging, there is the consoling feature about them that they always convey a greater lesson and are thus in some respects a greater friend to mankind than are the successes of life. A boiler may stand a test of 250 pounds under hydraulic pressure and be called a success, while the same boiler may explode under 175 pounds steam pressure and be called a failure. In the one case the boiler was called safe, while in reality it was a menace to public safety. In the other it was shown to be unsafe and while the explosion might have been disastrous, it probably taught the lesson in design that was needed and, before constructing future boilers from the same drawings, changes could be made that would make a repetition of the explosion impossible.

Entered at the Post-Office in New York City as Second-class Mail Matter.

MACHINERY

A practical Journal for Machinists and Engineers, and for all who are interested in Machinery,

PUBLISHED MONTHLY BY

THE INDUSTRIAL PRESS,

9–15 MURRAY STREET, NEW YORK CITY.

ONE DOLLAR A YEAR, POSTAGE PREPAID, TEN CENTS A COPY.

FOREIGN SUBSCRIPTIONS ONE DOLLAR AND FIFTY CENTS A YEAR.

Lester G. French, Editor.
Fred E. Rogers, Associate Editor.

The receipt of a subscription is acknowledged by sending the current issue. Remittances should be made to THE INDUSTRIAL PRESS, and not to the Editors. Money enclosed in letters is at the risk of the sender. Changes of address must reach us by the 15th to take effect on the following month; give old address as well as new. Domestic trade is supplied by the American News Company or its branches.

We solicit communications from practical men on subjects pertaining to machinery, for which the necessary illustrations will be made at our expense. All copy must reach us by the 5th of the month preceding publication.

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AUGUST, 1900.

CIRCULATION STATEMENT.

The regular edition of MACHINERY for August is 21,500 copies. MACHINERY has the largest paid-in-advance circulation of any mechanical paper in the world. No subscriber is entered on our mailing list until his subscription is paid for, and all subscriptions are stopped at expiration. Except on special quarterly numbers, no papers are sent free other than to advertisers, exchanges and circulation agents. AMERICAN MACHINERY is the title of the foreign edition, printed on thin paper and comprising all the reading and advertising matter in the domestic edition. The regular editions of MACHINERY for the last twelve months are given below:

1899.		1900.		1900.	
September...	18,000	January.....	20,000	May.........	21,500
October......	17,500	February . . .	20,500	June.........	27,500
November...	17,750	March.......	25,000	July..........	22,000
December...	18,500	April.......	21,500	August......	21,500

This number of MACHINERY completes the sixth volume. The index for the year will be ready about September first, and will be mailed to all who send a request for it.

* * *

Prof. Jacobus, in describing the system of instruction at Stevens Institute, recently said: "For every principle given in the class room the students are required to either make or witness an experiment to verify the same. What a student does with his hands in connection with his head he remembers much better than any knowledge he may obtain from the text books or lectures alone."

A reversal of this statement might be made that would be applicable to every young mechanic who aspires to better things for the future. Such mechanics have plenty to do with their hands. The simple doing of these things over and over in a mechanical sort of way may enable them to turn out more pieces in a day and to make the pieces better. Both of these results are to be desired, because the more work a man can do, and do well, the more money he is worth; but it is also true that the more kinds of work he can do, and do intelligently, the more money he is worth, and the only way to accomplish this result is to work with both mind and hand.

* * *

USELESS AND USEFUL ATTACHMENTS ON MACHINE TOOLS.

The writer recently visited a well-known Government works, and in one of the shops devoted to light work noticed a large number of engine lathes of from 14" to 20" normal swing, which were all provided with the gap arrangement, so that their capacities could be considerably increased for face-plate work.

While it is not denied that a gap lathe is a useful tool for some shops, especially those having a limited equipment, it seems absurd to generally equip any department of a large shop with this form of tool which not only costs more than the simple form but which, by reason of its construction, is not as strong and durable. For instance, the carriage has to be so constructed that the cross-slide and tool will be out of the center towards the face-plate, to enable the tool to be used on the periphery of the work when using the full capacity of the lathe. Such a construction is, of course, not so well calculated to give as permanently good results as the form of carriage used on the simple tools. Simple tools of various sizes to suit the general class of work are always more satisfactory and less expensive.

While it is not known positively but that there might have been some valid reason in this instance for such a peculiar shop equipment as the one mentioned, it is pretty safe to assume that the reason for such an abnormal condition of affairs is traceable to the desire of those responsible for the purchase of the tools to have each machine a complete tool in itself, or rather one having a great range of adaptability. This condition is quite evident in many other shops when the immense number of machines equipped with compound rests and Slate taper attachments is noticed. In many cases these attachments represent an investment that makes no adequate return, as in most cases, neither of these is used enough to warrant the equipment of all the lathes of a large shop with them. The work requiring either or both attachments can usually be sent to a few lathes having these features, and the others may just as well, or better, be as simple as possible as far as the carriage arrangement goes.

A good plan which, however, is not generally feasible, is to have the compound rest interchangeable with the plain slide rest of a number of lathes of the same class. Under these circumstances each lathe is normally a plain slide rest with the advantages of stiffness and simplicity of carriage detail. When occasion arises making it desirable to use the compound rest, it is applied without much loss of time and is again removed when the work no longer requires it.

The cost of the compound rest and taper attachment would usually prove a better investment if put into a two-speed countershaft and a variable feed mechanism by which the machinist could quickly change the speed and feed of his machine to suit the work being done.

The importance of the two-speed countershaft as a means of cost reduction on many classes of work is often overlooked. With the best of intentions, the operator may often neglect to secure the proper speed for the work in hand, as it is often a physical impossibility to shift the driving belt to the proper step and at the same time attend to the manipulation of the tool. With the two-speed countershaft, the utilization of the two speeds bearing a considerable ratio to each other becomes second nature and is continually used. Of course, a variable speed countershaft giving a large number of speed changes by minute variations is still more desirable, but as yet the most of these devices, because of certain objectionable features, have not become as popular as they undoubtedly will in the future when improved and reduced in cost.

The importance of the variable feed mechanism is becoming quite generally recognized, and a number of lathe builders are now placing on the market machines which leave little to be desired in this direction.

* * *

The superimposed turrets for battleships win, by the late decision of the special naval board, and they will be placed on the five new battleships. While there is a disadvantage in placing "too many eggs in one basket," by placing four guns in practically one turret, the great gain in arc of fire and concentration of fire seems to have counterbalanced this disadvantage.

AMONG THE SHOPS.

SOME OF THE INTERESTING FEATURES OF THE SCHENECTADY LOCOMOTIVE WORKS.

During the year 1899, the Schenectady Locomotive Works, at Schenectady, N. Y., built 355 complete locomotives for domestic and foreign use. Of this number 63 were of the Schenectady compound type, or that having the high-pressure on one side and the low-pressure on the other, with the Pitkin intercepting valve by which the locomotive may be worked as a simple engine when starting a train. With the product of 1899, the total number of compound engines built by the Schenectady company is 239. To accomplish the total result for one year, or nearly one complete locomotive for every day, including Sundays, something over 2,500 men were employed, thus making these works the next chief industry of Schenectady to that of the General Electric Company, which gives employment to about 6,500.

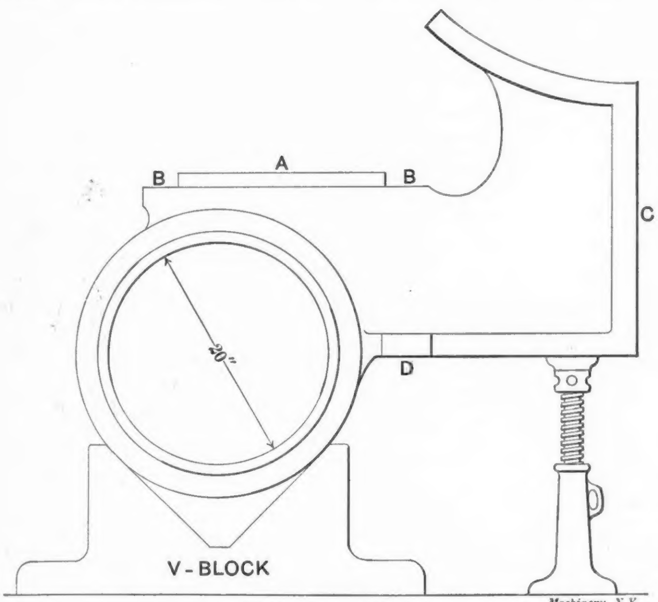


Fig. A. Jig for Machining Cylinders.

In the various views of the interior of the shops shown on pages 368 and 369, that of the foundry is denoted by Fig. 1. The foundry is a well equipped department for the class of work done and is served by traveling and jib cranes. The most remarkable feature noticed in this class of foundry work is the large number of cast-iron flasks that are shaped considerably like a locomotive cylinder, but larger. These are used for moulding the cylinders, and are made from cast-iron on account of the necessity of baking the moulds for a number of hours before pouring the metal. Dry sand moulding has to be practiced on locomotive cylinders on account of the complexity of the pattern and the impossibility of otherwise properly supporting the numerous cores for the tortuous steam and exhaust passages.

The general practice seen here will compare very favorably with that of any other class of foundry work, the successful casting of locomotive cylinders being regarded as one of the most difficult jobs encountered by the moulder.

The cylinders are machined in the cylinder shop shown in Fig. 2. The first operation is the boring of the cylinders, which is done in horizontal machines having traveling bars, to which are secured cutter heads. The flanges are faced in the usual manner with a cross-feed head attached to the boring bar, the feed of which is operated by the usual star-wheel and tappet. After being bored the cylinders are chucked on the planer in V-blocks, as shown in Fig. A, and are supported under the saddles by screw-jacks, which form a convenient and reliable blocking. The flanges at each end of the cylinder are turned to exactly the same diameter, so that when seated in the V-blocks the valve seat will be planed parallel with the bore. In the case of the low-pressure cylinder of the compound locomotive, it is necessary to proceed somewhat differently, as the flange cannot be turned to give the accurate chucking surfaces afforded by the smaller and simpler cylinder. When planing the low-pressure cylinders, discs which fit closely in the counterbores are inserted at each end and held in position by bolts through the cylinder. The ends of the discs are then allowed to rest in the V-blocks, the same as the flanges of the ordinary cylinder. The first planer shown in the foreground of Fig. 2 has a cylinder chucked on the platen in the manner described.

Simple cylinders are always planed in pairs so that, while all work of the same class is expected to be interchangeable, there will be no question but that the two cylinders for any simple locomotive will be alike in all respects. One of the little kinks in planer practice that help to economize time and promote the efficiency of the tools, was observed in the setting of the planer tools, when two heads were being used, so that both tools would either enter or leave the cut at the same time, thus making the travel as little as possible. The pattern for the simple modern locomotive cylinder is reversible; that is, a cylinder may be used on either the right or left side, as desired. This is effected by having the cylinder symmetrical on each side of the middle lateral vertical plane so that whether one end is ahead or the other, the relation towards its mate is exactly the same.

After the cylinders are planed, they are tested hydrostatically to about 400 pounds pressure per square inch. This pressure is obtained in a simple and ingenious method by a combination of differential pistons and cylinders, by which air pressure of about 100 pounds pressure is multiplied in effect until the resultant pressure is that stated. To confine the water so that the cylinder bore, the steam passages and the exhaust passages can be tested, cast iron blocks are bolted over the openings at the valve seat face with sheet rubber packing underneath and covers are also fastened over the steam and exhaust nozzles on the saddle. In this way each cylinder is carefully tested, and any leaks are located before the work goes any further. If the leak is a small one, owing to a sand hole, it is plugged, but if it be a crack or a porous spot the casting is condemned. The pressure is allowed to remain on each cylinder for a number of hours so that the smallest leaks are detected and remedied. The design of all the cylinders made here is such that the steam and exhaust passages are separated by an air space, which feature of isolation has an important effect in lessening the losses from condensation.

In this department, the steam chests are planed and drilled. The grooves for the copper joints are planed so a copper wire gasket about ¼" diameter will sink into the grooves to nearly one-half its diameter. To facilitate this operation and also the regular planing work, a simple chuck is used, which is shown by a top view in Fig. B. It consists of two square flat plates, the lower one of which is fastened to the planer platen and the upper one mounted on it with a central pin C as a pivot. A pin B at one corner locks the two together and T-slots D D D D are provided for clamping the steam chest in place. When the chest has been planed off and the gasket grooves made in one direction, the locking pin is removed and the chest with the upper plate is swung around to a position at right angles to that

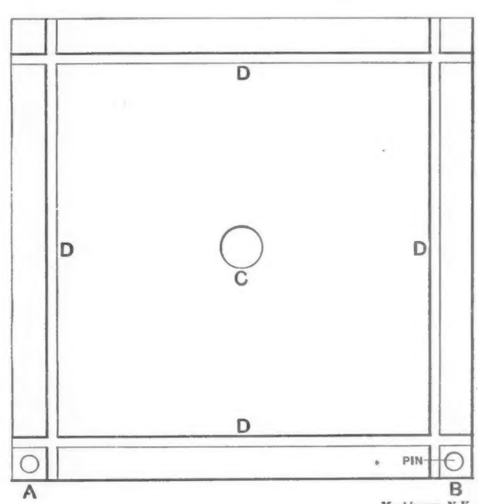
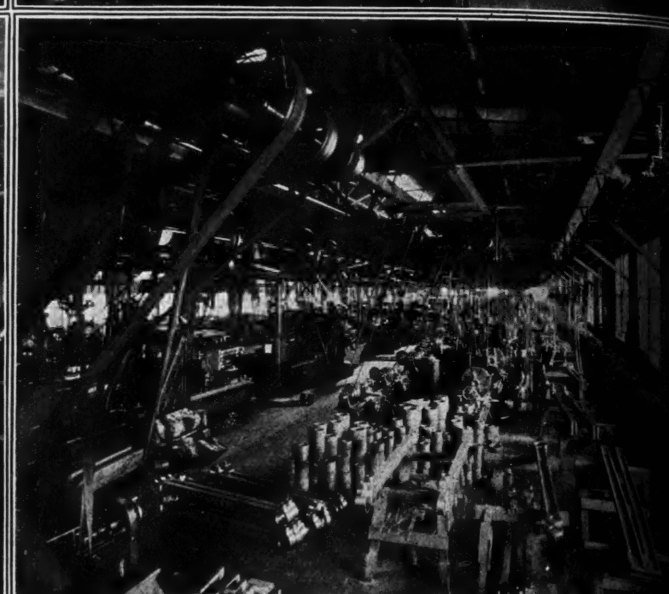


Fig. B. Jig for Planing Grooves for Gaskets.



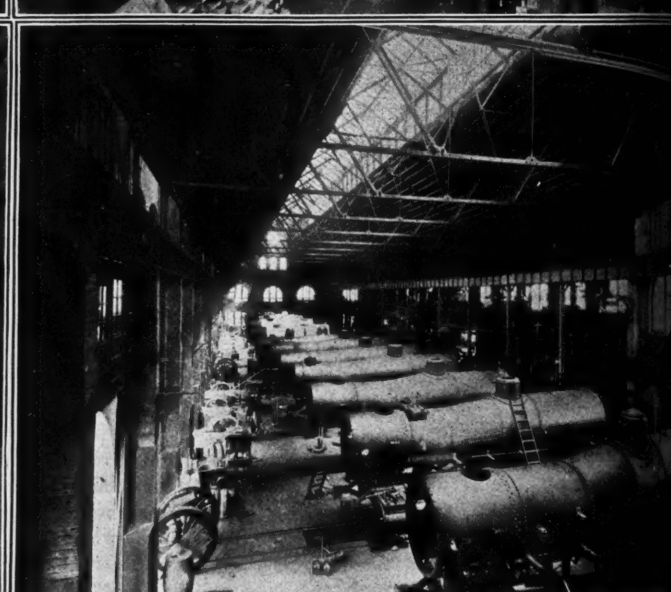


Fig. 1. The foundry. The flasks in front are for cylinders and are made of cast iron. After the mould is made for a cylinder the flask and mould are baked for a number of hours in a furnace.

Fig. 5. Heavy hammer department for frame work, etc.

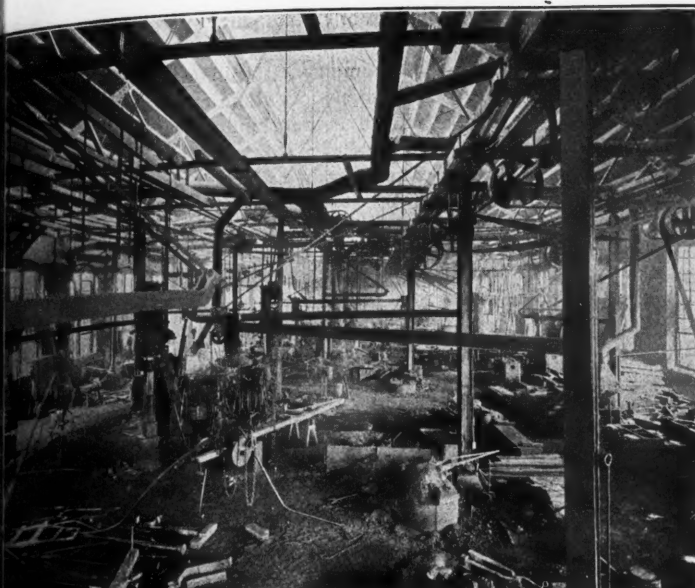
Fig. 9. View of the erecting shop, showing engines ready for delivery.

Fig. 2. Cylinder shop where the cylinders are bored and planed. The cylinder to the right in the foreground is for a compound locomotive.

Fig. 6. Department called the rod shop, where the main and parallel rods are machined and finished. The piles of rings in the foreground are the brass bushings for the solid-end rods, which are forced into place by hydraulic pressure, and which when complete take the place of the older form of strap and key rod ends.

Fig. 10. View of the erecting shop showing engines in process of erection.

VIEWS OF THE SCHENECTADY LO



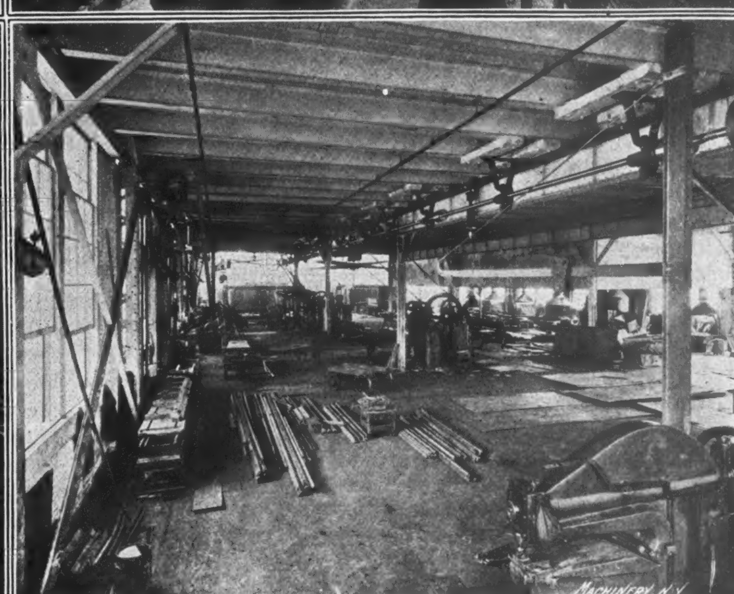


Fig. 3. Blacksmith shop No. 1, where the frames are forged.

Fig. 7. View of the first machine shop, showing triple-head frame slotter at the left and locomotive frames in the foreground in various stages of manufacture. The frame slotters, of which there are two, have traveling heads, the frame remaining stationary on the bed-plate.

Fig. 11. Another view of the first machine shop, showing the department for driving-wheel work.

Fig. 4. No. 2 blacksmith shop, where the lighter iron work is forged.

Fig. 8. Boiler shop served by two traveling cranes. This department contains an immense hydraulic press, which forms the shapes in sheet metal shown in Fig. 13.

Fig. 12. Tank shop, where the sheet metal work for the tenders is done.

SCHENECTADY LOCOMOTIVE WORKS.

previously occupied and the locking pin again engaged with another hole provided in the base.

The forging of a locomotive frame is a difficult piece of work and one requiring special aptitude and experience in the work. Some of the best frame forgers in the Shenectady works are not blacksmiths in the sense of being able to do any class of work, but are, in many instances, helpers who have never worked on any other class of work but this. When the opportunity has presented itself, they have been promoted to directing the work, and are thus specialists in heavy and intricate forging and welding. Steel frames are now used somewhat instead of wrought iron, being cast in the form required.

The views of the blacksmith shops given in Figs. 3, 4 and 5 will give an idea of the appearance and arrangement of the forges and steam hammers. The five large hammers shown in Fig. 5 have heating furnaces over which are steam boilers heated by the waste gases, and which supply the steam for the hammers and other purposes in the shop.

The frames are planed and slotted all over. While the planing of the frames is not especially interesting, the slotting of the jaws and other parts not operated on by the planer is somewhat out of the ordinary. This work is done on gang slotters, Fig. 7, each having three traveling heads and each head being usually in charge of a mechanic. The frames are always machined in pairs or, as sometimes may occur, two pairs are piled up and bolted to the bed-plate. The frames remain stationary, and all feeds of the slotter tool depend on the longitudinal or lateral travel of the head. The oldest frame slotter was observed to have been imported from Leeds and the other is the product of Bement & Miles. The period when the first machine was purchased probably marks the time when special tools of this class were all imported, the period of the second that when special machinery of the heavier types began to be supplied by our own builders, while the present is the time when American shops not only supply their own needs but also a good portion of those of other countries.

An interesting department is that seen in Fig. 6, where the main and parallel rods are machined. The forgings for this class of work are made extremely rough, no attempt apparently being made to have the forgings conform closely to the shape of the finished product as it has been found cheaper to approximate the general shape and depend on the machines to remove the excess of metal. The milling operations carried on here are done largely with cutters made from low grade, or what is generally known as machinery steel. The cutters are made up as usual and are case-hardened to a considerable depth. The loss from breakage and cracking when hardening is practically nothing, and the work of the cutters in steel and wrought iron is said to be highly satisfactory. The cutting edge is found to be about as durable as with the higher grades of steel, the breakage of teeth is greatly reduced and the first cost of the cutter is considerably less than those made of tool steel, especially those made in the larger sizes, as in them both the cost of the material and the time required for machining is more apparent.

When it is considered that these cutters are used by contractors who take charge of the production of certain parts at a piece price, paying the men employed by them, but having all their tools and material provided by the company, it will be understood that if the cutters give satisfaction under these conditions they ought to be very reliable for any other kind of service. Some cutters are also used made from cast iron with inserted mushet steel cutters. All the parallel rods are made in the I-beam section and are milled from the solid metal. The I-beam section of the main-rod tapers from the cross-head to the crank-pin end so that it is necessary to plane out the metal instead of using the milling cutter. It appears that here is an opening for some inventor to devise a form of milling cutter which will expand or contract in width as it travels along the length of the cut, a probably not impossible feat, but perhaps one not practicable in the present state of the art and when submitted to the tender mercies of many machine operators.

The rod ends are milled on the exterior or vertical milling machines, all the shapes being arcs of circles or combinations of them, so that no special devices are necessary. The oil cups are machined from the solid metal so that they form an integral part of the rod. This feature of construction is rendered desirable by the modern high speeds which are often sufficient to break off the neck of the ordinary brass cup on account of the centrifugal force developed. The loss of an oil cup on an express locomotive is a serious mishap, as the absence of lubrication might easily cause a ruined crank-pin and a considerable delay on fast trains, if nothing worse. As these cups are made this danger is obviated, and as the covers screw into the top with a fine thread of large diameter, they are also quite secure. The boss for the oil cup is first drilled and bored out to the desired size. The exterior is then turned off while in position under the drill-press by a tool having a teat which engages with the bored hole and having an exterior cutter to turn the outside. The feed is obtained from the drill-press spindle driving the tool.

The ends of the rods are bored considerably larger than the crank-pins and bushings of anti-friction metal such as brass, bronze, Ajax metal, etc., pressed into the rods by an hydraulic press. No provision for wear is allowed on the parallel rods of the modern locomotive, as it has been found more economical both in first cost and maintenance to discard the halved brasses, strap and key arrangement. The latter have both the advantage and disadvantage of being easily adjusted for lost motion. In the hands of the careful engineer, the strap rod is an economical construction, although quite expensive in first cost; but when the adjustments are made by careless or ignorant persons, the results are disastrous, especially on engines having more than two pairs of coupled driving wheels. In the case of the solid end rods, the bearings are allowed to run in practice until the lost motion becomes considerable and then are repaired by removing the old bushing and substituting a new one. The simplicity of the arrangement and the impossibility of the engineer making improper adjustments makes these forms of parallel rod practically the standard in the present American practice.

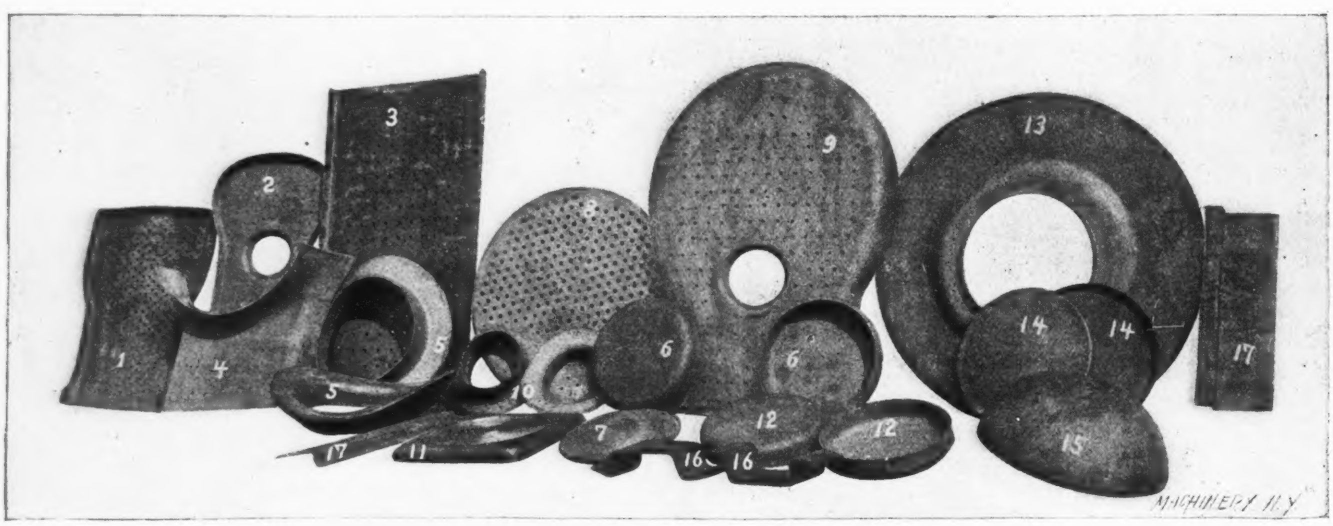


Fig. 13. Samples of the Pressed Work now used in Locomotive Construction.

On the main or connecting rods it is necessary to adhere to the adjustable form, as here lost motion would be a serious defect on account of the reversal of thrust at the end of each stroke. Then, again, the danger from improper adjustment on the connecting rod is not as great as on the parallel rods.

An instance of "making a piece stronger by making it weaker" was noticed in the form of the piston rods of one locomotive being built for a Western road. The piston rods were "necked down" just outside of the cross-head, by which means greater elasticity is obtained at a point where the bending action is always concentrated. In connection with the subject of piston rods, a method of construction demanded by some railroad companies is worthy of comment, and that is of having the piston rod tapers ground into the cross-heads with oil and emery. Just what advantage is gained over a good lathe fit on this work is more than the writer knows, but if the idea is, as it apparently appears to be, to get a perfect fit, it is exactly contrary to some railroad practice. It is believed in some quarters to be better practice to fit a taper piston rod slightly tighter on the small end than at the shoulder, so that portion of the rod embraced by the keyway shall be in compression rather than in tension. In any event, it appears according to the canons of modern practice as though grinding piston rods into the cross-heads is a practice that should speedily become obsolete.

The boiler shop is an extensive building having galleries at the sides and provided with two traveling cranes for handling boilers and material. Chipping, calking, tapping stay-bolt holes, screwing in stay-bolts and other work is done by compressed air tools supplied by a Norwalk compressor. Perhaps the most striking tool in this department, both in its appearance and the work turned out, is the huge hydraulic flanging press made by the Morgan Engineering Co. With it are formed many shapes that only a few years ago were made entirely from castings. Boiler fronts, dome connections, steam chest casing tops, flue sheets, cylinder head casings, etc., are formed by pressure while hot. Some samples of the work of this press are shown in Fig. 13. The advantages arising from pressed work of this kind are numerous. In the case of boiler front ends, the weight is considerably lessened, as is the case with many other parts. This is a desirable condition, although locomotives are continually being made heavier, but in the construction of the locomotive there is no trouble to get weight. The effort is to get rid of superfluous weight where not needed and put into the boiler where the demands are never satisfied. Again, flue sheets and other portions of the boiler flanged by one or two operations are tougher and freer from the defects incident to the hammering and mauling that occur when hand work is the rule.

In Figs. 9 and 10 are given two views of the erecting shops taken from opposite ends. This department is served by traveling cranes having sufficient capacity to lift and transport a locomotive from one track over the others and deposit it wherever required. A transfer table on a track on the outside of the shop carries the completed locomotive to the switches where it can be delivered to the main line of the railroad.

The finely equipped drawing rooms recently built were described in the February issue of MACHINERY and constitute in their present state an important addition to the productiveness of the concern. The drawing department is an important department of any manufacturing firm and particularly so in the case of a locomotive shop as the great variety of designs demanded by different roads and the constant struggle to increase the efficiency and capacity of the locomotive make the labor in the drawing room never ending.

In conclusion, it may be said that the modern American locomotive, which the Schenectady company has done not a little to develop, never fails to win general admiration, and when its design is carefully studied, the more the mechanic will understand its adaptibility to the arduous conditions of service. At first, if unfamiliar with locomotive practice, he may be disposed to criticize the general looseness of the working parts until he understands that this condition is not a defect, but an absolute necessity on account of the more or less general unevenness of the roadbed and the prevalence of dust which, were the bearing closely fitted without lateral movement, would cause binding and heating. Judging the locomotive by its work and the results that follow, it may easily be regarded to be, in many ways, the greatest mechanical triumph of the present age.

ITEMS OF MECHANICAL INTEREST.

NOTES GLEANED FROM VARIOUS SOURCES.

From observations made in the General Electric Works at Schenectady, a twenty-five foot electrically driven boring mill was found to absorb 3 H. P. when turning the periphery of a large cast-iron spider. A similar mill of twenty feet capacity absorbed 1 H. P. when operating on light work. Nine planers 48" x 48" grouped and driven by one motor through line shafting, were found to require an average of 45 H. P. of which probably nearly 1-3 was absorbed by the shafting and belts. A great difference has been found in the power required for planers of equal capacity, but of different designs. Those having sharp V-slides on the platen were found in some instances to require as much power when running light as others having flatter slides did when doing heavy work. The actual power required to force the tool through the cut on a planer is a small proportion of that required to overcome the friction and inertia of the moving parts.

In the Gray shops, Cincinnati, one of the large planers was adapted for work that will not pass between the housings by the addition of two additional uprights, which rest upon a sole plate under the forward end of the planer. The sketch is a plan view of the planer and sole plate. The long, horizontal parallelogram represents the planer bed, under the left hand end of which is

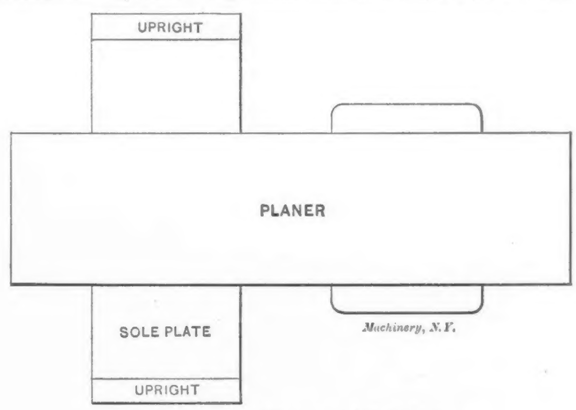


Fig. 1. Plan of Planer and Sole Plate.

the sole plate, as indicated. The two uprights slide in or out on the sole plate, as desired, in order to be located properly for the work, and thus the ends and sides of large and heavy pieces, far beyond the ordinary capacity of the planer, can be machined. This arrangement is not uncommon, but it is worthy of even more extended use.

Alloys of possible value, especially for castings, have sometimes been discovered in the course of research in the Mechanical Laboratory of Sibley College, Ithaca, N. Y. Two of these were recently described by Dr. Robert H. Thurston, in the "Sibley Journal of Engineering," as follows: " 'Alzinc,' as it has been generally termed, consists of two-thirds aluminum and one-third zinc. It has the general working quality of a very good cast-iron, but has only about four-tenths its weight (S. G. 2.9), works beautifully in the lathe and on the planer, and can be cast very fluid at a comparatively low temperature, making remarkably sound and even castings. Its tenacity is about 25,000 pounds on the square inch and, when warm, it is ductile, but it is brittle at low temperatures. Its cost is about two-thirds of aluminum. Another alloy, 'alzinctin,' contains 50 per cent. aluminum, 25 tin and 25 zinc. Its specific gravity is 3.17 and its cost is about 80 per cent. that of aluminum, a trifle higher that the preceding. It has a measurable ductility, even when cold, about 5 per cent., and is a better material for smaller parts and where some ductility and elasticity are desirable. Its tenacity is about 20,000 pounds per square inch. Both alloys, at the boiling point of water, become very much tougher and more ductile. No copper can be employed in making these alloys as it proves wholly deleterious."

AUTOMATIC FRICTION GEARING.

The "Mechanical World" publishes a description of a novel friction gearing in which the pressure between the two friction wheels is automatically regulated by the amount of power transmitted. In the sketch W is the driver which turns in the direction of the arrow. Wheel T is free to rotate or slide upon shaft

A within reasonable limits, and the shaft is cut with a course-pitch screw on which is the nut B. This nut slides in grooves F in the friction wheel T and hence when the nut turns, the wheel must turn also. A spiral spring S inserted between the nut B and wheel T tends to keep these two elements apart.

Suppose that wheel W turns in the direction of the arrow and that the driven shaft A meets with some resistance to rotation. At first wheel T and the nut B are turned through the frictional contact between the two bevel wheels, but the shaft A does not turn because of the resistance that it must overcome. The nut, therefore, moves to the right, owing to the action of the screw,

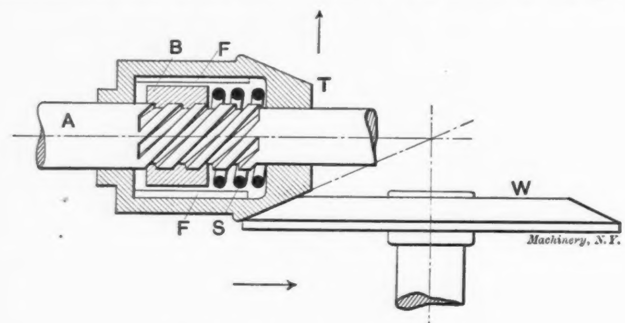


Fig 2. Detail of Automatic Device.

and compresses the spring, which causes the two wheels to be pressed together with still more pressure and also tends to lock the nut to the shaft. That is, a point will be reached where the end thrust will be great enough to produce sufficient friction between the threads of the nut and shaft to cause the shaft to turn with the nut. Should the resistance of the shaft increase, the end thrust would increase to correspond, thus reducing the slipping between the two wheels. Should the resistance decrease, the spring would be able to push the nut slightly to the left and reduce the end thrust. We do not know how practicable this device has proved to be, but it embodies an interesting principle.

PIN SORTING MACHINE.

One of the interesting machines (though ancient) seen in a pin factory at Winsted, Conn., is that which separates the bent and defective pins from the perfect ones. The principle is illustrated in the accompanying sketch which shows the upper side of a number of parallel leather belts about 1½" wide, having cemented fastenings so that no lacings interfere with the separating action. The belts all travel slowly in the same direction, being driven from a common shaft and the pins are dropped on their upper surfaces from a hopper at the left end. During the travel towards the right, the perfect pins roll off while the bent and defective ones continue to the end where they are dumped in the scrap box. The separating action is assisted by giving

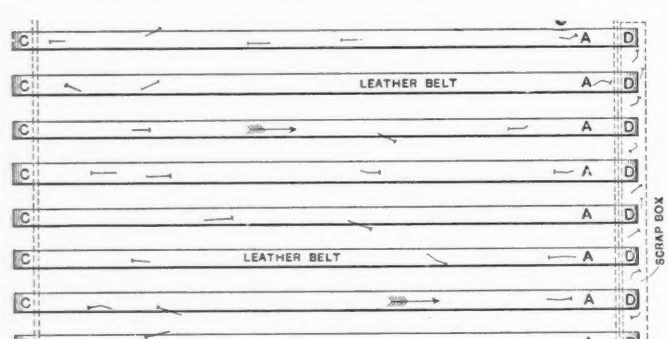


Fig. 3. Plan of Pin Sorting Machine.

the pulleys C C C C, etc., and D D D D, etc., a slight wabbling action as they turn, thus communicating a rocking action to the belts. Often a pin will be observed to go through the machine to the scrap box that appears all right, but when closely examined, it will almost invariably be found that if not slightly bent, the head is eccentric or has a fin which prevents it from rolling, which is, of course, the secret of the machine's action. The perfect pins roll off of the traveling belts, while those that are at all crooked remain until they are deposited with the scrap.

A DELICATE INSTRUMENT.

An interesting little instrument has been devised and is used by Prof. C. H. Benjamin in the laboratory work at the Case School of Applied Science, Cleveland, Ohio. It is described in the notes on laboratory practice by Prof. Benjamin, which are published by Charles H. Holmes, Cleveland, Ohio. The instrument is an extensometer for measuring the extension or contraction of a specimen during a tensile or compressive test. As the distortion in such cases is usually very small previous to the point where the elastic limit is reached, it is necessary to have a delicate means for measuring it. Micrometer calipers are generally used similar to those described by Prof. Miller in his article upon "Testing the Strength of Materials" in the March number of this paper. It is desirable, however, to have an instrument which does not require repeated adjustment and this end is accomplished in the one illustrated in the accompanying sketch.

It consists of two vertical bars, F F, connected together by two round pins at one side. These pins are threaded for thumb nuts which serve to close the bars together, and spiral springs between the two bars serve to separate them. Each bar is provided at the lower end with a steel point to bear on the specimen T and at the upper end with a light steel lever in a horizontal position. The two levers are marked A and B in the sketch.

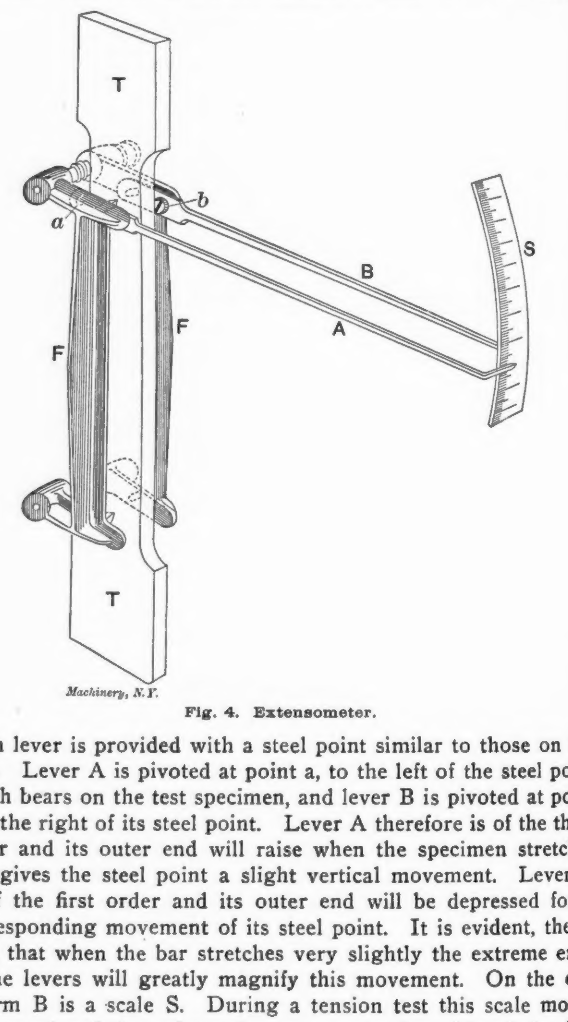


Fig. 4. Extensometer.

Each lever is provided with a steel point similar to those on the bars. Lever A is pivoted at point a, to the left of the steel point which bears on the test specimen, and lever B is pivoted at point b to the right of its steel point. Lever A therefore is of the third order and its outer end will raise when the specimen stretches and gives the steel point a slight vertical movement. Lever B is of the first order and its outer end will be depressed for a corresponding movement of its steel point. It is evident, therefore, that when the bar stretches very slightly the extreme ends of the levers will greatly magnify this movement. On the end of arm B is a scale S. During a tension test this scale moves downward and the pointer A moves upward, making it feasible to read ten-thousandths of an inch upon the scale per inch length of specimen. It is evident that with this instrument the spaces on the scale can be twice as far apart for a given length of lever arm as would be necessary if the scale were stationary and the pointer A alone moved.

* * *

In most shops bar stock is placed in horizontal racks and when a piece is wanted it must be pulled out its full length and then replaced. If the piece happens to be at the bottom of the heap, so much the worse. At the Cleveland Twist Drill Co.'s works, where a large quantity of round stock must be carried, all the medium and large bars are stood on end in suitable racks. This makes a very convenient arrangement where the bars are stiff enough to stand without bending.

SHOP KINKS.

A DEPARTMENT OF PRACTICAL IDEAS FOR THE SHOP.

Contributions of kinks, devices and methods of doing work are solicited for this column. Write on one side of the paper only and send sketches when necessary.

To encourage our readers to send more descriptions and photographs of good shop kinks and handy devices, we will give contributors the privilege of selecting from the appended list of desirable machinists' tools, according to the value of the different devices submitted.

To compete, it will be necessary to observe the following conditions:

1.—All descriptions shall be written on one side of the paper only.

2.—The necessary sketches to illustrate the device shall be made on separate sheets from the written matter.

3.—Tools shall be chosen from the following list, as no option in the selection of other tools can be given.

All contributions to this department will be graded, according to value, into four classes. Contributors will be informed by mail during the month following publication, from which class they may make their selections. Cash payment will be made in all cases, if preferred.

		List Price.
1.	Starrett's No. 9 combination square, 12-inch blade, with center head and bevel protractor	$4.00
	Sawyer's No. 100 surface gage with 12-inch and 18-inch spindles	3.50
	Slocomb's No. 17 outside micrometer caliper	3.50
2.	Sawyer's No. 39 combination square with 12-inch hardened blade	2.50
	Starrett's No. 56 tool maker's case-hardened surface gage, without auxiliary guides	2.50
	Slocomb's No. 12 internal micrometer caliper with depth gage attachment	2.50
	Starrett's No. 11 combination square, 12-inch blade, with center head	2.00
3.	Slocomb's No. 11 internal micrometer caliper	1.75
	Starrett's No. 13 4-inch square, with two blades	1.65
	Starrett's No. 15 universal bevel	1.50
	Sawyer's No. 18 spring tempered rule, 12 inches long	1.25
4.	Starrett's No. 40 screw pitch gage	1.00
	Sawyer's No. 19 flexible rule, 9 inches long	.90
	Starrett's No. 79 outside spring caliper, 4 inches	.75
	Starrett's No. 73 inside spring caliper, 4 inches	.75
	Starrett's No. 83 spring dividers, 4 inches	.75

METHOD FOR THREADING SMALL SCREWS.

"S. C. Rew" says: I enclose a kink for threading very small rods. A four-jawed universal chuck is screwed on the spindle of the head-stock and the die is held in the chuck.

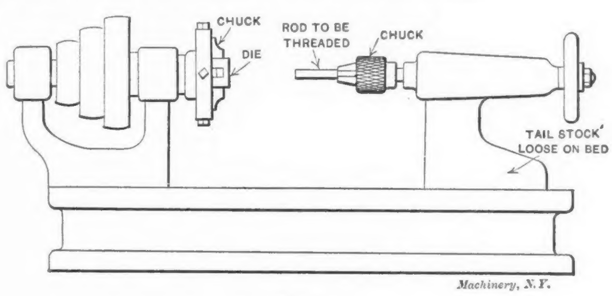


Fig. 1.

The tail stock is not fastened to the bed and the rods are held in the chuck. Where a number of small rods are to be threaded this will be found a very convenient and rapid rig. The tail-stock is pushed up until the rod touches the die, after which the die does the feeding. Reversing is done by countershaft.

A GOOD COMBINATION TOOL.

C. W. Shelly, Peterboro, Ont., says that Starrett's lock-joint hermaphrodite calipers No. 42 answer the purpose of three separate tools. By bending two extra points A and B into the

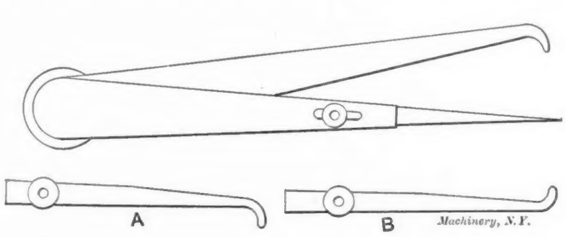


Fig. 2.

proper shape it will do for inside calipers and also as a gage for distances between holes and slots. The illustration Fig. 2 will make this clear. It economizes room in the tool box and also saves expense.

PLANER POPPETS.

W. W. Cowles, Torrington, Conn., says that sketches Figs. 3 and 4 show two handy poppets for the lathe, planer, milling machine, surface grinder, etc. The poppet shown in Fig. 3 is made of cast steel as cast-iron is too brittle. The illustration shows its form clearly. The poppet shown in Fig. 4 can be made very cheaply as a number can be formed at once. It is made from a bar of machinery steel any length and 1¼" thick by 2½" wide. The bar is planed so that a cross-section is of the form

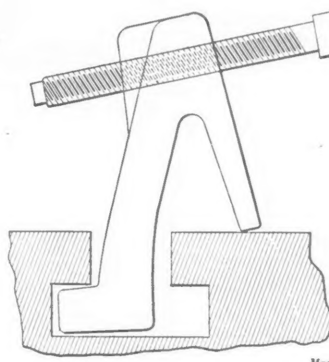


Fig. 3.

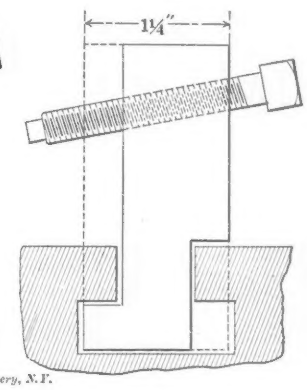


Fig. 4.

shown by the full lines and then is sawed into sections about 1¼" wide. A half-inch screw is large enough for this size. A half-dozen such poppets are very handy to have around a planer.

A HANDY TOOL.

George I. Babcock, Providence, R. I., says that a handy tool for the pattern maker to use for rubbing in corners is made by taking a steel ball and inserting into it a shank of stiff steel wire

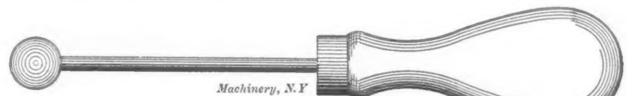


Fig. 5.

on which is mounted a handle as shown in Fig. 5. As the balls can be obtained in any size, a number of these tools of various sizes can be supplied to suit any fillet.

LATHE TOOLS FOR TURNING CIRCULAR GROOVES.

H. J. M. describes two forms of lathe tools that are well adapted for accurately turning grooves or fillets of any desired radius. The tool shown in Fig. 6 has a circular cutter B which is turned with a shank fitting the hole through the holder A and is held in position by the nut C on the under side. The cutter B is turned slightly tapering for clearance and can be made concave on top or can be ground to an angle as shown. As these

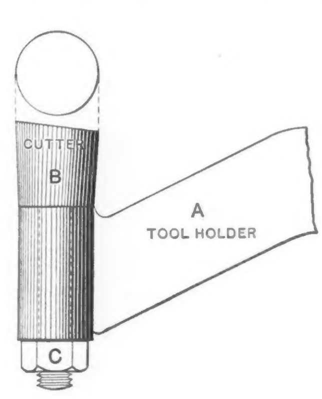


Fig. 6.

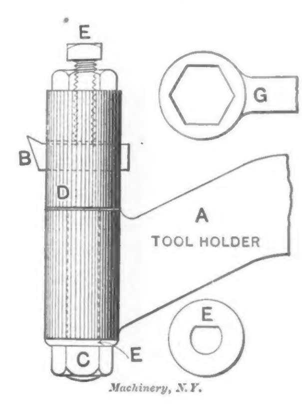


Fig. 7.

cutters are easily turned in a lathe to exactly any diameter required, it is best for accurate work to have one for each size of radius required. When circular grooves of a larger diameter are required than would be practicable to turn with a forming tool, the tool shown in Fig. 7 is well adapted for the work. The tool B can be adjusted by loosening the set-screw E. The turret D fits freely in the holder A, which is held in the regular tool-post of the machine. The end of the shank of D is fitted with a washer E having a hole fitting over the flattened side of the screw. This prevents the nut C from being moved from its proper adjustment by the revolving action of the tool when cutting the groove. A wrench G is provided to fit on the hexagon shape at the top of the turret D to enable the operator to turn it with facility.

HANDY DIE FOR THE BLACKSMITH SHOP.

"G" illustrates a simple and convenient die for the blacksmith shop by Fig. 8. These dies can be made for a variety of shapes, the one shown being intended for pins like that shown at A. The loop connecting the formers B B is made so that it has a certain degree of springiness and opens after each blow of the sledge or tilt hammer on the back of the formers. Such dies are extensively used in some shops and form a valuable addition to the equipment. Fig. 9 shows a method of obtaining the right throw for a belt shifter when the head room is too short to allow of the proper leverages being obtained. A wrought-iron piece

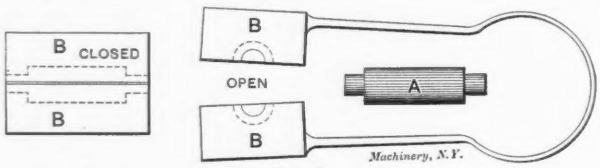


Fig. 8.

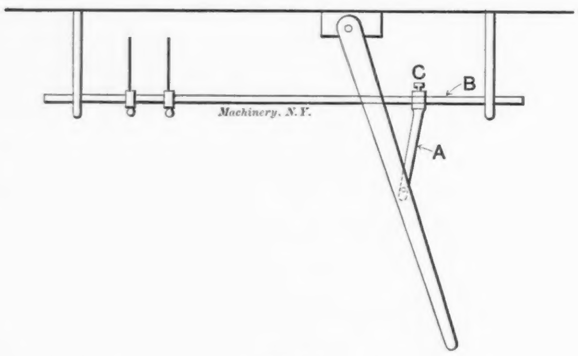


Fig. 9.

A is forged with a boss, through which is drilled a hole for the rod A carrying the belt fingers. A set-screw C holds it in position. The length of A is made such that it may be connected to the shifter lever at a point that will allow the belt to be shifted with a convenient movement of the shifter lever.

LAPPING HOLES WITH EMERY CLOTH.

Lawrence E. Cutter, San Francisco, Cal., sends a shop kink which has been found useful by him. He says that while there is nothing very brilliant or new about the idea, by means of it a very creditable job was turned out.

We had a number of bronze valve liners to bore and turn which were 18½" long by 2" bore by 2½" diameter. They were bored with a cutter bar and rosebit reamer on a hollow spindle lathe, but were a little small when finished, as allowance was to be made for pressing into place so they would be 2" standard bore when in place. I made a sort of lap of wood, as shown in Fig. 10, and by its use a very smooth hole was made which was of the required size.

I got a piece of wood 2" square by about 2 feet long and whittled down the end (or turned would be better) for about 3", a loose fit for the holes, and then somewhat smaller in diameter

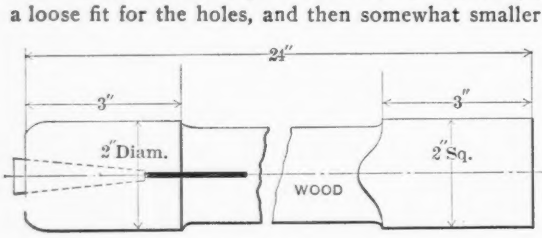


Fig. 10.

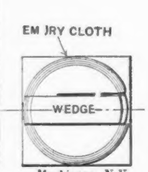


Fig. 11.

to within about 3" of the other end, which was left square to be held by a monkey wrench. A slot was then cut wedge shaped at the end, as shown, and fitted with a wedge and a strip of emery cloth (see Fig. 11). The end was made slightly tapering so as to readily enter the hole, and the wedge was hammered in till the end was a tight enough fit in the hole. Plenty of emery and oil were used and the holes were quickly lapped out the required size. The whole thing was made inside of twenty minutes, and, although very simple, it did the work.

TOOL-SETTING GAGE.

Joseph Aspenleiter, Cincinnati, Ohio, sends a description of a simple tool, by the use of which, he says, there is no danger of turning a piece of work too small at the beginning of the cut and which is also a time saver, as there is no need of trying the calipers two or three times to see if you have the right size. Simply make your lathe tool touch point A Fig. 12 when the gage is against the tail-stock sleeve or the mandrel on which the work is turning. Suppose you have a number of pieces to be turned to the same size, such as large or small pulleys, gear sectors where the calipers cannot be used, etc., simply turn the

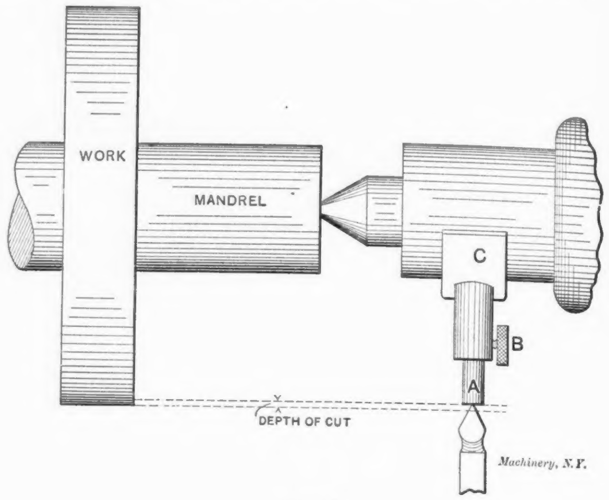


Fig. 12.

first one to the desired size, then set the tool from the mandrel to the cutting edge of the lathe tool. When you turn the next piece, set the lathe tool to the point A and you will have the correct size. Further explanation is unnecessary, as the accompanying sketch will give a clear idea of the tool which any machinist or lathe hand can easily make for himself and will find very useful.

CUTTING MULTIPLE THREADS.

John Bissett, Haildon, N. J., refers to a letter in the March number about cutting multiple threads and states that he has recently had to cut 350 quintuple screws. The rig used for the purpose is shown in Fig. 13. A small face plate was made, and five equi-distant holes were drilled in a circle and pins were driven into the holes for the purpose of driving the work, as

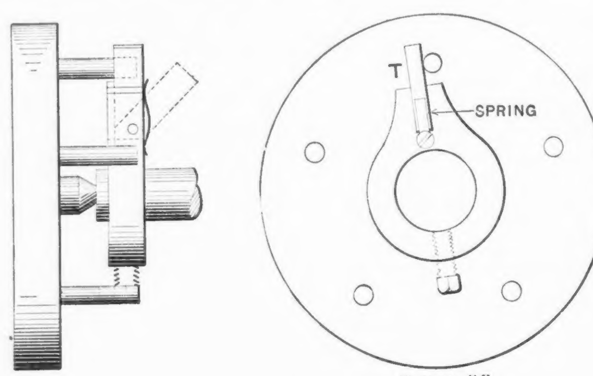


Fig. 13.

indicated. A special dog was used with a "tail that could wag." That is, there was a piece T pivoted in a slot and kept in position by a spring. After cutting one thread the piece T would be moved out to enable the dog to pass by to the next pin, when, by letting piece T spring back into position, the next thread could be cut at a distance equal to 1-5 the lead from the first one.

* * *

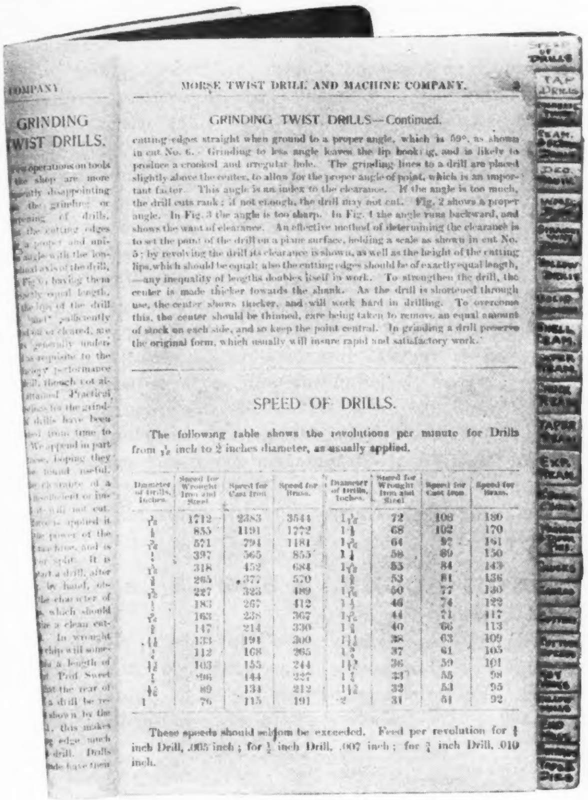
It is reported that the North German Lloyd Steamship Line has placed an order with the Vulcan Shipbuilding Company of Stettin, Germany, for an ocean liner that will eclipse any vessel ever built in regard to size and power, while its speed will exceed that of any other vessel in the Transatlantic trade. The length of the new vessel will be 752 feet and it will have propelling engines of 45,000 H. P. The average speed to be maintained is to be 25 knots or practically 28¾ common miles per hour. This rate of travel compares favorably with the average railroad speeds between terminal points.

LETTERS UPON PRACTICAL SUBJECTS.

MARGINAL INDEXING FOR CATALOGUES.

Editor MACHINERY:

The following scheme was adopted by me for selecting tools for automatic screw machines. With each new job it was necessary to give the foreman data for cams, box tools, drills, taps,


MORSE TWIST DRILL AND MACHINE COMPANY.

GRINDING TWIST DRILLS—Continued.

cutting edges straight when ground to a proper angle, which is 59°, as shown in cut No. 6. Grinding to less angle leaves the lip hooking, and is likely to produce a crooked and irregular hole. The grinding lines to a drill are placed slightly above the center, to allow for the proper angle of point, which is an important factor. This angle is an index to the clearance. If the angle is too much, the drill cuts rank; if not enough, the drill may not cut. Fig. 2 shows a proper angle. In Fig. 3 the angle is too sharp. In Fig. 4 the angle runs backward, and shows the want of clearance. An effective method of determining the clearance is to set the point of the drill on a plane surface, holding a scale as shown in cut No. 5; by revolving the drill its clearance is shown, as well as the height of the cutting lips, which should be equal; also the cutting edges should be of exactly equal length,—any inequality of lengths doubles itself in work. To strengthen the drill, the center is made thicker towards the shank. As the drill is shortened through use, the center shows thicker, and will work hard in drilling. To overcome this, the center should be thinned, care being taken to remove an equal amount of stock on each side, and so keep the point central. In grinding a drill preserve the original form, which usually will insure rapid and satisfactory work."

SPEED OF DRILLS.

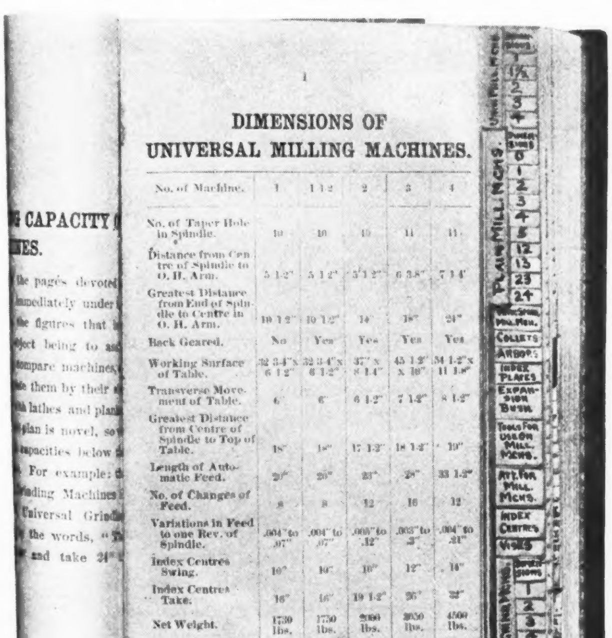
The following table shows the revolutions per minute for Drills from $\frac{1}{16}$ inch to 2 inches diameter, as usually applied.

Diameter of Drills, Inches.	Speed for Wrought Iron and Steel	Speed for Cast Iron	Speed for Brass.	Diameter of Drills, Inches.	Speed for Wrought Iron and Steel	Speed for Cast Iron	Speed for Brass.
$\frac{1}{16}$	1712	2383	3544	$1\frac{1}{16}$	72	108	180
$\frac{1}{8}$	855	1191	1772	$1\frac{1}{8}$	68	102	170
$\frac{3}{16}$	571	794	1181	$1\frac{3}{16}$	64	92	161
$\frac{1}{4}$	397	565	855	$1\frac{1}{4}$	58	89	150
$\frac{5}{16}$	318	452	684	$1\frac{5}{16}$	55	84	143
$\frac{3}{8}$	265	377	570	$1\frac{3}{8}$	53	81	136
$\frac{7}{16}$	227	323	489	$1\frac{7}{16}$	50	77	130
$\frac{1}{2}$	183	267	412	$1\frac{1}{2}$	46	74	122
$\frac{9}{16}$	163	238	367	$1\frac{9}{16}$	44	71	117
$\frac{5}{8}$	147	214	330	$1\frac{5}{8}$	40	66	113
$\frac{11}{16}$	133	194	300	$1\frac{11}{16}$	38	63	109
$\frac{3}{4}$	112	168	265	$1\frac{3}{4}$	37	61	105
$\frac{13}{16}$	103	155	244	$1\frac{13}{16}$	36	59	101
$\frac{7}{8}$	96	144	227	$1\frac{7}{8}$	33	55	98
$\frac{15}{16}$	89	134	212	$1\frac{15}{16}$	32	53	95
1	76	115	191	2	31	51	92

These speeds should seldom be exceeded. Feed per revolution for $\frac{1}{4}$ inch Drill, .005 inch; for $\frac{1}{2}$ inch Drill, .007 inch; for $\frac{3}{4}$ inch Drill, .010 inch.

Fig. 1 Illustrating Method of Indexing.

etc., and I was obliged to continually refer to catalogues for sizes of such tools. Not always being able to find just what was wanted as quickly as I wished, it occurred to me that a marginal

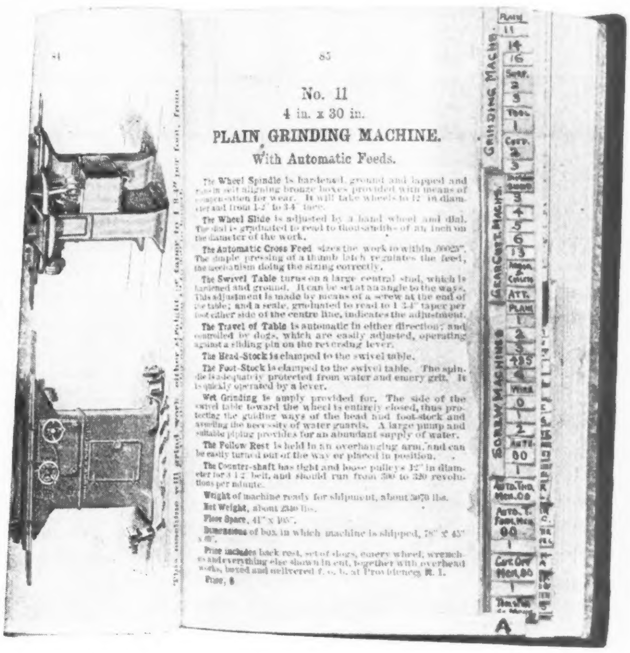

1

DIMENSIONS OF UNIVERSAL MILLING MACHINES.

No. of Machine.	1	1 1-2	2	3	4
No. of Taper Hole in Spindle.	10	10	10	11	11
Distance from Centre of Spindle to O. H. Arm.	5 1-2"	5 1-2"	5 1-2"	6 3-8"	7 1-4"
Greatest Distance from End of Spindle to Centre in O. H. Arm.	10 1-2"	10 1-2"	14"	18"	24"
Back Geared.	No	Yes	Yes	Yes	Yes
Working Surface of Table.	32 3-4" x 6 1-2"	32 3-4" x 6 1-2"	37" x 8 1-4"	45 1-2" x 10"	54 1-2" x 11 1-8"
Transverse Movement of Table.	6"	6"	6 1-2"	7 1-2"	8 1-2"
Greatest Distance from Centre of Spindle to Top of Table.	18"	18"	17 1-2"	18 1-2"	19"
Length of Automatic Feed.	20"	20"	23"	28"	33 1-2"
No. of Changes of Feed.	8	8	12	16	12
Variations in Feed to one Rev. of Spindle.	.004" to .07"	.004" to .07"	.008" to .12"	.003" to .2"	.004" to .21"
Index Centres Swing.	10"	10"	10"	12"	14"
Index Centres Take.	16"	16"	19 1-2"	26"	32"
Net Weight.	1730 lbs.	1730 lbs.	2160 lbs.	2050 lbs.	4500 lbs.
Floor Space.	67" x 67"	67" x 67"	76" x 67"	90" x 90"	116" x 91"
Price.					

Fig. 2, showing one of the Indices for a small Catalogue.

index would be a help. So I took a Morse Twist Drill catalogue and indexed it as shown in Fig. 1. The index was printed with drawing ink and the surface shellaced. In order to strengthen the edges I pasted an additional thickness of paper on the back along the index edge. This proved so satisfactory that I indexed some other catalogues that I have occasion to use quite often, one of which is the Brown & Sharpe Mfg. Co.'s catalogue. Even with the great variety of machines and small tools, an index can be made as shown by Figs. 2 and 3. Some small catalogues are spaced so that the entire index can be made within the length of the pages, but for a catalogue like


85

No. 11
4 in. x 30 in.
PLAIN GRINDING MACHINE.
With Automatic Feeds.

The Travel of Table is automatic in either direction; and controlled by dogs, which are easily adjusted, operating against a sliding pin on the reversing lever.

The Head-Stock is clamped to the swivel table.

Fig. 3. Catalogue opened to Index "A" in Fig. 2.

that of the Brown & Sharpe Mfg. Co., it must be arranged as follows: Index the length of the page, leaving a strip at the bottom to use as a holder for opening to the next set of indexed sheets, as indicated by A. Now, if what you wish to find is not on the first index, Fig. 2, place the thumb at A and open to the second index, shown in Fig. 3, and so on.

If the catalogues should have a little more margin, the index could be made more complete. This scheme would hardly be practical except in cases where the catalogues were used very frequently for reference; and they are generally not of sufficient value to justify the expense of providing such an index on the part of those issuing the catalogues. EDWIN C. THURSTON.

Providence, R. I.

* * *

TOOL CHESTS.

Editor MACHINERY:

All the different mechanics have, or think they should have, some kind of tool chest. The mason has an old sack; the plumber, a piece of Brussels carpet; the moulder will wrap his tools in an old shirt, if he has one; if not, he will put them in his hip pocket; a blacksmith will wrap his in a leather apron; the machinist, patternmaker, and carpenter, use a box or chest. All these different chests are made of a variety of material, and the workmanship is of all the different grades as best suits the individual taste and wealth of their proprietors. Some of these chests are fearfully and wonderfully made, while others are models of workmanship, neatness and design. The possession of a fine tool chest with its complement of fine tools does not, by any means, indicate a good mechanic; nor does the non-possession indicate any more, for we have all seen beautiful failures, with and without tools or chests. Now, I don't want to be understood as advocating the idea of trying to get along without the use of tools and a proper place to put them. Far from it, for these indicate methods and system, two very essential features of success. But above all this, a fine mechanic must have a good brain, and the man that has his tools in his head makes a hit with me, for he is always ready.

I saw, some time ago, what I considered a good example of this kind of mechanic. A young machinist had been sent by a prominent engine builder to investigate a high speed engine that

had been giving trouble. After investigation it was found necessary to bore the cylinder, which he concluded to do in position. The engine was a 10 x 10 with an extra large piston and locomotive guides. He had a boring bar made at a neighboring machine shop, somewhat like Fig. 1, and of the proper dimensions. He then rigged up as shown in Fig. 2. The wood clamp, which was placed in the guides, formed the feed, the bar was a close fit for the stuffing box hole to give a bearing at the front end, and the wood bearing at the back end was made larger than the bar and when set in position was babbitted. The bar was turned by long cross handles in the holes at the extreme end. This rig, on short cylinders and under the man-

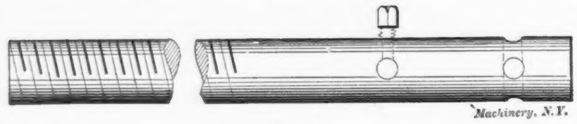


Fig. 1.

agement of a careful mechanic, will do very creditable work. Of course, the job required banding the piston head and refitting and a new set of rings. The machinist left this engine running in fine style, and all concerned felt very kindly toward him, and toward the company for sending a mechanic that did not "fall down."

Another very remarkable case came under my observation while mechanically connected with a large insane asylum. An insane patient, speaking a foreign tongue, made all his tools and supplies (except leather) and did all the repairs on the boots and shoes for over five hundred men, and this without the aid of any one or the expenditure of a single cent. He maintained this for almost a year, when the management grew ashamed of their neglect and gave him a good kit of tools. From that time

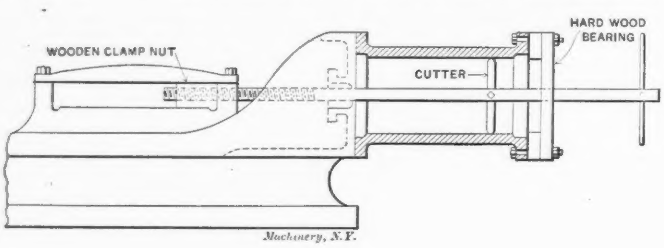


Fig. 2.

he lost all interest and could not be induced to work. He had made lasts, knives, plyers, shoe pegs, nails, wax ends, needles and everything he needed. His stock of leather was secured from old boots and shoes that he would gather in his wanderings about the place, but to look at his tools and then at his work this would seem impossible.

He also had a fad for making the numerous keys used about the institution, some of which were very difficult to make even for a good mechanic with good tools. I have seen as many as twenty keys taken from this man at one time and they were made so well that they were given to new employees. Of course, time "cut no ice" with him. This only illustrates the fact that if the tools are in the head, they can be had in reality.

CENTRAL WEST.

* * *

AN EXPERIENCE OF A TOOL-BUILDING FIRM.

Editor MACHINERY:

The trials and vexatious occurrences that sometimes befall the lot of the machine tool builder, are usually not well calculated to sweeten his disposition or increase his respect for the mechanical abilities or good judgment of some superintendents and foremen of shops buying and using his tools. To illustrate I will relate a ludicrous occurrence which is said to have taken place in the works of a huge electrical concern.

They had ordered a small lathe from a well known tool building firm whose products are generally regarded with favor wherever used. The lathe was duly built and shipped to the concern after it had been thoroughly tried and tested in every particular. A few days after the shipment was made, a sharp telegram was received from the superintendent of the electrical concern, stating that the lathe was "N. G.," that the spindle gear lacked ¼" of meshing properly with the feed and screw cutting train, etc.

A competent machinist was immediately sent to the works of the electrical company and arrived just as the head-stock of the supposedly defective lathe was being set up on the planer to remove the superfluous amount from the under side which was thought to be necessary in order to let it down to the proper position. A halt in these proceedings was immediately called and a searching investigation of the lathe made. It was found that in pursuance of the general policy of examining all tools bought for the company, the lathe head-stock and apron had been taken apart to ascertain the condition of the bearings, after which tests were supposedly made to determine the condition of the machine as regards accuracy of alignment, although it is difficult to believe that these tests could have been carried out in an intelligent manner in the light of subsequent developments.

It was found that in some way during the examining process, the jaws of the head-stock embracing the back box of the spindle had been jammed on the side by some careless workman and that when the box was replaced, it did not seat within about ¼" of its true position. In this constrained condition the spindle had been run and attempts had been made to test it for alignment, etc. On account of the gears not meshing properly it had been concluded that the only way out of the difficulty was, as stated, to plane off the offending portion from the bottom of the head-stock.

What the status of a superintendent or foreman of machinists can be who would order or sanction any such remarkably foolish proceeding as this, is more than the writer can say, but he is assured that the facts as given here, are substantially correct.

Hoboken, N. J. R. P. PERRY.

* * *

COMPOUNDING A SIMPLE LATHE.

Editor MACHINERY:

I was recently required to cut a triple screw, with pitch of 1" on a lathe with only two change gears, no other lathe being available. The lathe was indexed from 2 to 36, and in order to do the work I had to make a new stud to hold two more change

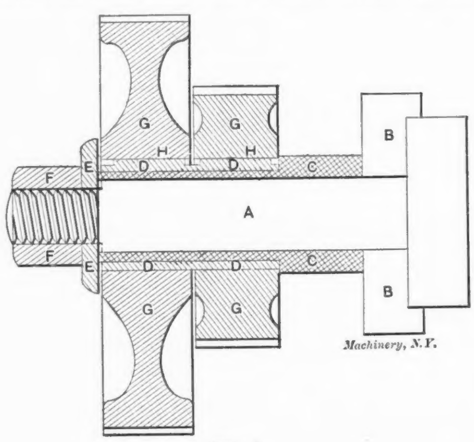


Fig. 1.

gears, in place of the idler, moving the idler to another position.

The addition of the two change gears made it necessary to lengthen the lead-screw the width of one gear.

The arrangement for holding the extra change gears is shown in Fig. 1. A is a square head bolt which passes through frame B and is a good fit in sleeve C. D is another sleeve with feath-

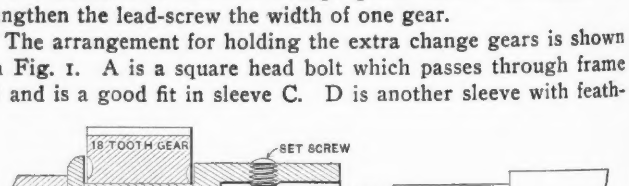


Fig. 2.

ers, on which the gears are placed, and slipped over the sleeve C.

The sleeve D should be 1/32" shorter than the distance between the shoulder of sleeve C and the washer E. When the nut is screwed on, it forces the sleeve C against the frame B and clamps the whole very firmly in place. The two gears on sleeve D should then revolve freely in unison.

Fig. 2 shows the device for lengthening the lead screw. It is made of machinery steel. It should have a key-way in the bore

and be an easy driving fit on end of screw. A set-screw helps to hold it in place. The end is turned to fit the hole in the gears and is supplied with a key, nut and washer.

Fig. 3 shows the arrangement for holding idler. A is a flat piece of machinery steel, drilled to receive the stud B, one end of which is turned to fit the hole in the gear, allowing same to revolve freely.

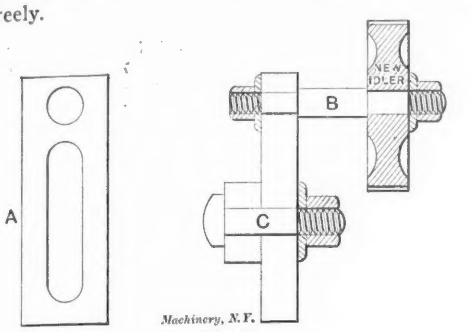


Fig. 3.

The piece is secured to the frame by means of a bolt C. The flat piece A is slotted to allow for adjustment.

Fig. 4 shows the extra change gears, A A' and the idler B in its new position. The lathe index called for 72-tooth gear on stud and 18-tooth gear on screw to cut 2 threads per inch. By using 2 to 1 (30 and 60) on the new stud, the lathe was geared to cut 1 thread per inch. I used a 48 gear for the idler, as it was the most convenient size.

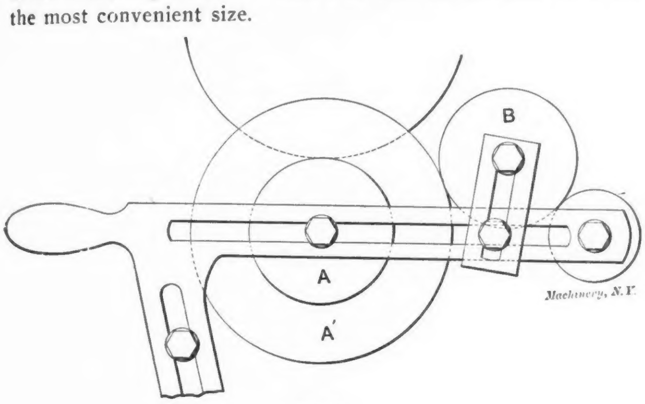


Fig. 4.

In order to cut the three threads evenly I scored a circle on face plate of lathe with a sharp pointed tool, and laid out and drilled very accurately three holes, to receive the dog, numbering them 1, 2 and 3. Starting at No. 1, I cut the three threads very handily.

These several devices cost very little to make and form a valuable addition to the equipment of the lathe.

Lancaster, N. Y. R. B. Casey.

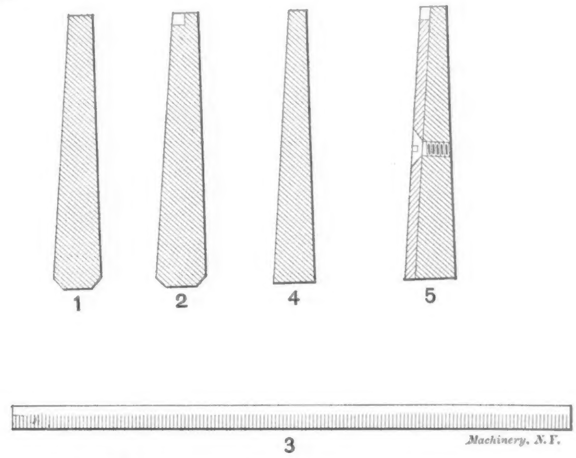
* * *

KNIVES FOR CUTTING RUBBER, LEATHER, FIBER, ETC.

Editor Machinery:

If there is anything that dulls the edges of knives, it is cutting such material as sole leather, sheet packing, vulcanized fiber, etc. It might also be added that cork is troublesome to cut, but that if the knife be greased it will cut this about as a hot knife cuts butter. Water, soap suds, or better yet, a strong solution of potash may be used when cutting rubber.

If it be desired to cut out gaskets, or other forms which may be curved or irregular in outline, out of thick material, which makes a knife dull and the operator tired and profane, a pair of shears may be rigged up which cut with very little effort through stuff up to ½" thick. The entire trick is to keep the material from sliding or slipping before the advancing blades, and to prevent the upper blade from twisting it sidewise over the lower one. Naturally, the best way to prevent slipping is to roughen one of the surfaces on which the material tends to slide. We will assume that we have a stout short pair of shears that we wish to convert to the new system and take it for granted that the upper blade is the right-hand one. Grind the lower blade square across at right angles to the face against which the upper one works—having first drawn the temper. The section is now as in Fig. 1. Next, take a fine chisel and, just as though cutting the thin edge of a knife-edge file, make fine teeth in the upper edge, only leaving an uncut line along the edge of the working face, as shown in cross-section in Fig. 2 and in edge view in Fig. 3. The blade is now re-hardened and the cutting edge carefully ground and oil-stoned. The device is then assembled and will be found to cut through tough material with little effort. All the sharpening the lower blade will require is a little rubbing with an oiled Turkey stone, care being taken to leave no wire edge.



End and Edge Views of Knives for Cutting Sheet Material.

In some instances it may be more feasible to make the blade like Fig. 5. Draw the temper of the lower blade, grind it to the section shown in Fig. 4, drill and tap two screw holes and screw to it a separate thin blade, the upper edge of which has been filed or chisel-cut to form the teeth. Robert Grimshaw.

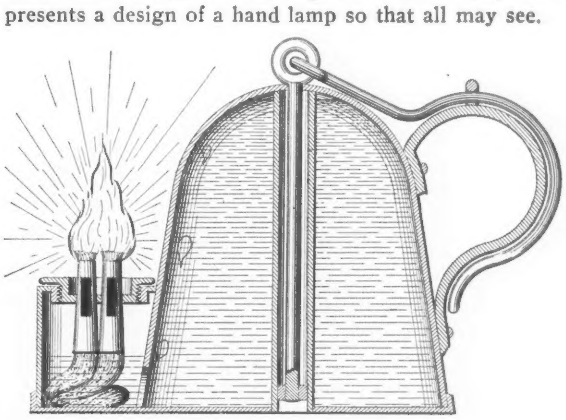
Paris, France.

* * *

PNEUMATIC SELF-HEATING LAMP.

Editor Machinery:

One of the small things which tries the patience of the machinist in cold weather, is the congealing of the oil in his hand lamp, when it is most needed. Many pieces of work cost more than they should from this cause, and many have been ruined for the want of a good light. Considerable time and oil are lost in the effort to make them burn, and often the lamp is ruined by having the seams melted apart while thawing it over a fire. It is a common sight in winter time to see a half dozen men around a fire warming the oil in hand lamps, so that they will burn for a while. These lamps have often been consigned to a "warm place" by mechanics, but I hope St. Peter will not record this, as there are extenuating circumstances. As the writer does not wish to "hide his light under a bushel," he herewith presents a design of a hand lamp so that all may see.


Self-heating Lamp for the Shop.

It is self-heating, requires less attention than other lamps, and will burn from ten to fifteen hours with a good light. It will burn an inferior grade of oil, as the proximity of flame to the shell of the lamp keeps the oil warm and in a fluid state. It will keep the oil from congealing in the coldest weather and in the most exposed places. It does not require much capillary attraction to lift the oil to the flame, as the oil is always near the burner. In the ordinary hand lamp, the capillary attraction of the wick has a refining or separating influence upon the oil; that is, the finest qualities of the oil are filtered through the wick, as it offers the least resistance. They are consumed first, leaving a

residuum of heavy oil, which clogs the pores of the capillary tubes in the wick that elevates the oil to the flame. Hence, a poor light with the lamp half full of oil, requiring constant refilling to get a good light. We soon have a lamp full of oil that the attraction of the wick is not strong enough to lift to the flame, and that is often thrown away for a fresh supply and new wick.

Most oils are adulterated, but this self-heating lamp will consume the adulterants. The wick is fed from the bottom of the reservoir, using the heavy oils or adulterants first, and the best quality of oil last, thus insuring a good light from the beginning to the end of the charge of oil. Under the most favorable conditions and with the best quality of lamp oil, the hand lamps in general use soon become dim, as the capillary attraction of the wick is not strong enough to elevate the oil any great distance, and from this cause alone twice the time is spent in keeping a good light in comparison to the self-heater. In filling this lamp it has to be tilted so that the burner space becomes the top, when placed in an upright position. The pressure of the air will retain it in the reservoir. When the oil is used below the opening, a bubble of air passes in, forcing the oil into the wick space.

There are other features about this lamp which will recommend its use. When employed as a hanging lamp, it can be turned to any point on its swivel, to accommodate the workman, and when not in use the hook can be stowed away around the handle and under the catch which forms a thumb hold. This lamp may cost more to manufacture than the others. It is like all other good things; it comes a little high, but the time and oil saved by this pneumatic self-heating lamp will make other lamps dear, even as a gift.

GEO. C. STANLEY.

Norfolk, Va.

* * *

GASOLINE ENGINES.

Editor MACHINERY:

Some recent experiments on a form of gasoline engine in which an explosion is secured every revolution, while the Otto cycle is retained and there are no fake explosions, has brought into notice a little point of difficulty more or less common to all internal explosion engines. I refer to the premature explosions that sometimes take place in an apparently inexplicable manner. We discovered the existence of the fault in the above engine by accident, or at least inadvertently, for we switched off the electric igniter and the engine continued to run and explode.

Obviously there could be only one reason for this, namely, the incandescence of some internal part. Gas engines have long been known to be capable of running with no intentional means of ignition, and the cause has been found in the projection of a bolt head at the back of the piston. This projected into the compression space and became red hot, and in that state was found sufficient to fire the charge; and except for the difficulty of securing explosion exactly to time, there is no reason why the ignition tube flame should not be extinguished after the engine has been run long enough to heat up some internal projecting piece sufficiently to explode the charge. In some forms of petroleum engine the same principle is utilized in the shape of a narrow-necked cast-iron bottle bolted to the back of the cylinder, and so proportioned as to its capacity and the length of the bottle neck that explosion will occur at the correct time. The explosions keep the bottle in a state of incandescence. The petroleum is sprayed upon its internal surface and the air charge in the cylinder is driven from the piston into the bottle and explodes at the right time, because the air then forms an explosive mixture with the vapor.

The difficulties experienced with this form are several. The cast-iron bottle requires to be renewed from time to time, because it becomes very rotten with heat and finally is ruptured. Secondly, if the load on the engine is very light, the engine is apt to refuse to work at all. This is because the amount of oil burned is not sufficient to maintain the bottle incandescent, and it fails to explode the mixture or to sufficiently vaporize the charge. When it was not possible to procure petroleum engines of a power small enough for their intended duty—engines of 3 H. P. being about the smallest to be obtained at the time I have in mind—this trouble involved complete remodeling of the bottle or vaporizer by casting additional ribs in it and by protecting it from loss of heat, so as to maintain its incandescence. But there was a great tendency amongst the men sent out to put up and start engines to arrange a convenient plank brake against the flywheel whereby, of course, the work was increased and the vaporizer kept warm. Very slight differences of surroundings would enable an engine to run or cause it to stop when under light load with a cold vaporizer. On one occasion we found that an engine would run with closed engine room doors, but stopped soon after the door was opened. The cause was obviously the cool current of air acting at the critical temperature to cool the vaporizer below ignition point.

In one little petroleum motor, the sparking device projecting from the back head some little way into the cylinder became very hot, and, though of very small bulk, it proved quite sufficient to ignite the compressed charge. It did not, however, produce any evil result, as it happened to produce explosion exactly at the right time, and would not have been found out had we not happened to shut off the spark and the engine ran merrily on.

Gasoline engines have a certain advantage in the fact that their explosive mixture enters the cylinder very cold, and suitable direction may be made to chill off this igniter, if desired, prior to the compression attaining the intensity of explosion. Though a small matter, it is one that may, perhaps, be usefully known to some who have not had cause to suspect its existence. Automobile work is so novel, and there is so much to be found out. I have known one little fault, which might have been effectually cured by a few minutes' work with a smooth file, to be the cause of a five month's delay. Anything and everything seemed to be reasonably suspected except the little fault really at the bottom of all the trouble. But doubtless here I am preaching to many who know these things from experience.

London, Eng. W. H. BOOTH.

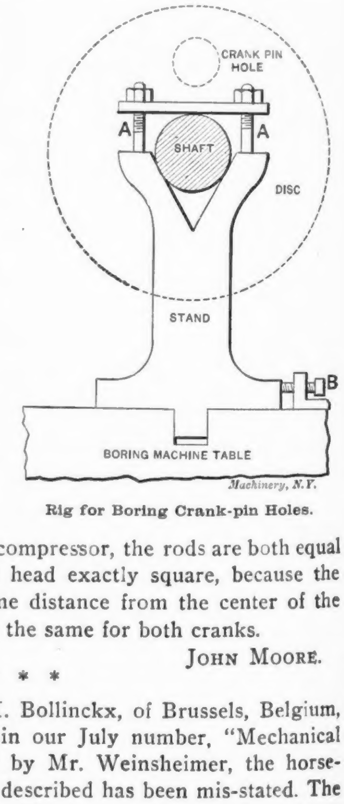
* * *

BORING CRANK-PIN HOLES.

Editor MACHINERY:

I herewith give a sketch and a brief description of the method employed in our shop to bore crank-pin holes so that they will all be of uniform throw and square with the shaft. First, the crank shaft holes are bored to proper size, then the discs or fly-wheels are roughed off all over. These fly-wheels and discs are for air compressors that I have seen built.

A sketch of the stand, of which there are two, is here shown. There are two studs, A A in each, for clamping the crank shaft into the vees. The machine has a slot in the center of the table, parallel with the spindle, in which the tongues of the stands go. A set-screw B is provided, which forces the tongue of each V-stand against one side of the slot, so that the stands always come exactly in line. The table can be raised or lowered so as to bore the crank-pin-holes to any throw. If the machine is marked, you always get the same throw without measuring each time. This way of doing the work brings the holes exactly in line with the crank shaft in all directions, so that when they are on the compressor, the rods are both equal in length, and pull the cross head exactly square, because the center of both pins is the same distance from the center of the shaft, the throw being exactly the same for both cranks.



Rig for Boring Crank-pin Holes.

JOHN MOORE.

* * *

We are informed by Mr. H. Bollinckx, of Brussels, Belgium, that in the article published in our July number, "Mechanical Features of the Exposition," by Mr. Weinsheimer, the horse-power of some of the engines described has been mis-stated. The engine of Carels Freres is 1,500 H. P.; that of Vande Kerckhove of 1,200. The power of the German engines is about one-half that stated in the article.

EPICYCLIC GEARING.—3.

APPLICATIONS IN BEVEL GEARING.

The epicyclic bevel gear train, such as is shown in its elementary form in Fig. 1, possesses properties that are both interesting and useful. There are five parts in Fig. 1, the shaft, the arm K, upon which turns the intermediate bevel pinion B, and the main bevel gears A and C which are in mesh with pinion B. There are several conditions that can exist with a tran of this description.

First, suppose gear A to be stationary and C to be loose on the shaft. If the shaft and the arm K turn, carrying the intermediate pinion B with them, C will make two turns for every one of the arm. Also, if A, instead of being stationary, should itself rotate, this motion, combined with that of the arm, would modify the motion of the last gear C, and it would also make a difference whether the first gear turned in the same or opposite direction as the arm.

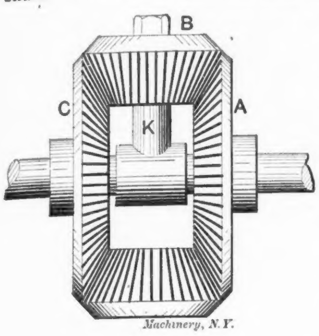


Fig. 1.

Second, suppose the above condition to be reversed, and one of the bevel gears A or C to be driven, while the other is stationary; or both to be driven, while the arm K, which carries the bevel pinion constitutes the driven element. Where only one gear is driven, the arm will turn in the direction in which the gear turns and with half its speed. Where both gears are driven in the same direction, the arm will follow in the same direction and with a speed intermediate between the two. If both gears are driven in the opposite directions, the arm will follow in the direction of the more rapidly moving gear.

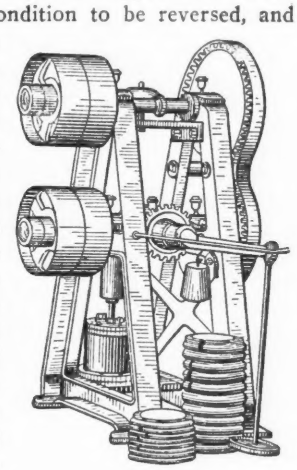


Fig. 2.

Third, suppose arm K to be fixed and A and C loose on the shaft. If A is the driver, the pinion B will simply transmit motion to gear C, and the force tending to rotate the arm K will be just one-half the force transmitted from A to C.

An application of this last principle is found in the familiar Webber differential dynamometer, shown in Fig. 2. The arm of this dynamometer, which supports the scale pan, also carries two bevel pinions corresponding to pinion B in Fig. 1. This arm pivots on a shaft upon which are two bevel gears in mesh with the pinion mentioned, like gears A and C in Fig. 1, and power is transmitted through this train of gearing, the amount of power being measured by the weights in the scale pan.

In the May number of this paper, in an article upon the application of the epicyclic principle to spur gearing, reference was made to an ingenious crank motion that was used by Chas. E. Barrett, a New England mechanic. Ten or fifteen years ago Mr. Barrett had another device, of which he made a model, and while it was of little practical value, the model excited the wonder of those who saw it operate, but were not initiated into the secrets of its "modus operandi."

All that was visible was a long box, through which apparently ran a straight shaft from end to end. On one end of the shaft was a crank and on the other end, apparently, a wheel. Upon turning the crank, however, the wheel would make several times as many rotations as the crank, and the reason for this unexpected performance was to many a mystery. The secret of the model is shown in Fig. 3, and while it does not correctly indicate the details of construction, it will serve to illustrate the principle. There are three sets of gears, marked 1, 2 and 3, respectively, and four bearings marked 4, 5, 6 and 7, for supporting the gears and their shafts. Starting at the right in the illustration, the handle is pinned to a short shaft passing through bearing 7 and on the other end of which is a hub, K, with two arms, on which the gears, B, B, turn. The gear, A, meshes with gears B, B, and is fast to the frame, so that it cannot turn. Gear C meshes with gears B B, and is pinned to a short shaft turning in bearing 6, and on the other end of which is another double arm K', with its set of gears in all respects like K and its gears. One turn of the handle causes K and gears B B to rotate about the axis x y, and gears B B also have a rotation about their own axes because of their contact with gear A. The result is that gear C will make two turns, or twice as many as arm K. In the same way gear C' will make twice as many turns as gear C, or four turns, and the last gear, C'', will turn eight times, as will also the flywheel, which is connected with gear C''. One turn of the handle, therefore, will cause the flywheel to turn eight times, and if there were another set of bevel gears the flywheel would turn sixteen times, and so on.

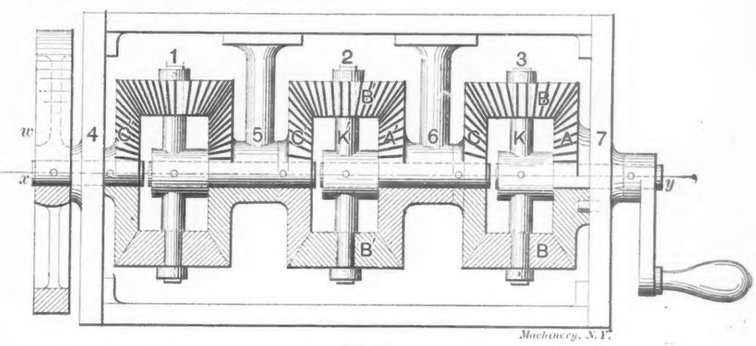


Fig. 3.

While this may not be very practical mechanism, it illustrates nicely the first principle enumerated above. A further illustration of the same principle, though somewhat more complicated in its action, is the so-called compensating gears of automobiles. One of these, as adopted by the Riker Motor Vehicle Co., is sketched in Fig. 4. The gears are placed in the hub of one of the rear wheels, and so connect the rear or driving wheels with the motor that either wheel can move faster or slower than the other, to accommodate the curves or irregularities of the road over which the carriage travels. The motor drives the sleeve D, from which the two wheels of the vehicle are driven indirectly through the gearing in one of the hubs. The sleeve carries a frame B, which supports the pins upon which the two intermediate bevel pinions turn. Gear A, which meshes with these pinions, is keyed to the shaft S, at the right end of which is keyed the hub of one of the carriage wheels. Gear C, which also meshes with the pinions, is keyed to the hub H of the other wheel. The two wheels are thus connected to the driving power through the intermediate pinions, the frame B and the sleeve D. The result is, that while the pinions may be driven about the axis of the shaft S at a constant speed, either wheel is free to turn alone or at a different speed from the other, according to the resistance that it must overcome. The compensating gear of the Riker vehicles is of neat design and makes it unnecessary to have the shaft in two parts, as is sometimes the case.

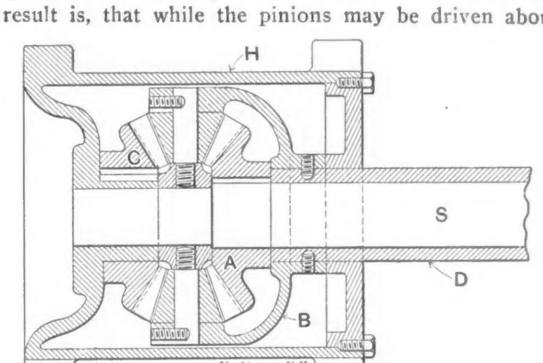


Fig. 4.

Compensating Gearing.

Another compensating gear for a totally different purpose, but of peculiar interest because of its adaptation to machine shop requirements, is graphically portrayed in Figs. 5 and 6. This application is to be found at the Builders Iron Foundry Shops, Providence, R. I., and was designed by Mr. F. N. Connet, of Providence, for driving a lathe. There are in use in these shops two old lathes that served their country in the manufacture of ordnance for the civil war, and have since faithfully done their

duty in a great variety of operations. One of these has been built over with an extra headstock at the "tail" end of the bed and the spindle of this headstock is driven by a pair of worms and a worm-wheel. A rope drive of peculiar construction is employed for transmitting power from the countershaft to the worms, and the compensating gear alluded to is placed on the countershaft, and is so connected with the rope sheaves that the ropes drive each worm uniformly and cause it in turn to do its share of the work, in spite of any inequalities.

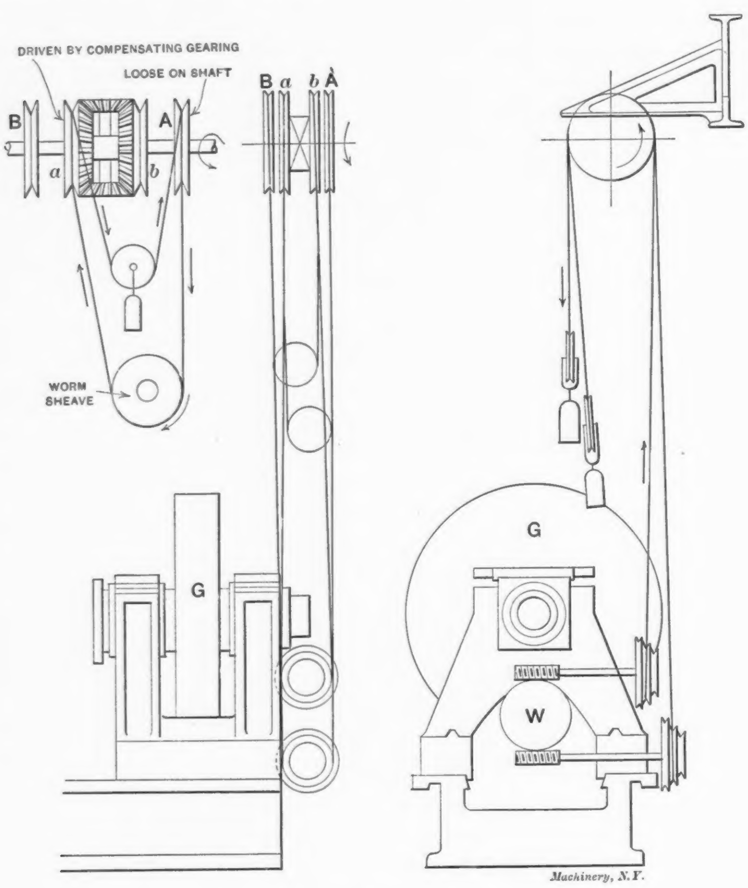


Fig. 5.

In Fig. 5 are two views of the headstock and countershaft, with the rope drive. The spindle is driven by a large internal gear, G, through a pinion on the same shaft with the worm-wheel W. The worm shafts have three-stepped sheaves and the countershaft above is suspended from a bracket attached to an I-beam. There are four sheaves on the countershaft labeled a, A, b and B. Sheaves A and B are loose on the shaft, while a and b are flexibly connected to it through the compensating gearing. A separate rope is used to drive each worm, and the tension of the ropes is maintained by weights suspended from pulleys, as indicated, one of which is represented as hanging at an angle for the sake of clearness in the illustration. The course of the ropes can be followed by the aid of the diagram in the upper left-hand corner of Fig. 5. Sheave a is the driver, while A, which is loose, simply guides the rope back to the worm sheave after it has left the weight pulley. For driving the other worm, sheaves b and B are used in a similar manner, b being the driver.

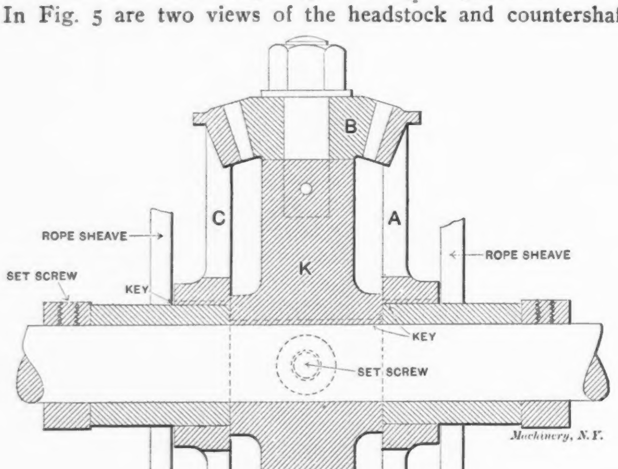


Fig. 6.

Fig. 6 is reproduced from the working drawing of the compensating gear used for driving this lathe. The arms of the two sheaves, which are lettered a and b in Fig. 5, are indicated in the drawing; and to the hubs of these sheaves are keyed the bevel gears A and C. The bevel pinions, B B, turn upon pins in the arm K, which rotates with the shaft. If one sheave meets with a greater resistance than the other, it will fall behind the other, as in the case of the automobile gear, and automatically equalize the work done by the two.

Illustrations of Case 2.

In the three last examples cited it will be noted that the arm carrying the intermediate bevel pinions is the driver, while the two main bevel gears, or at least one of them, constitute the driven elements, substantially as explained under case 1 at the beginning. In most cases where this mechanism is applied, however, the arrangement is reversed and one or both of the two main gears are the drivers, while the arm carrying the pinions is the driven element.

An ingenious illustration of this is also to be found at the Builders' Iron Foundry, in the operating mechanism of the electric cranes in the foundry department. This mechanism was designed by Mr. Connet and has been patented by him.

In Fig. 7 is a general view of one of the cranes. There are two chains attached to the crane hook, one of which, A, passes up and over a pulley on the trolley, and over pulley 1 to the winding drum C. The other chain, A′, passes upward over its trolley pulley, to the left, over pulley 2, and finally over pulley 1′ to a drum located back of the drum C. The chains are made to wind upon their respective drums in opposite directions, and it is clear that if both drums be rotated in opposite directions, at the same speed, the effect will be simply to raise or lower the hoisting hook; while if the drums rotate in the same direction and at equal speeds, the chain will be taken in by one and slacked off by the other, while the hook and its load will be carried horizontally without raising or lowering. Any difference in the speed of the two drums, when moving either in the same

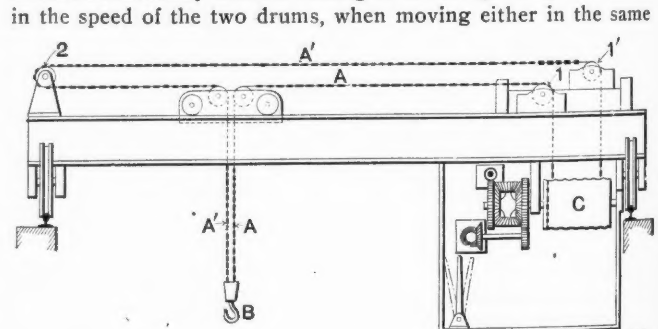


Fig. 7

or opposite directions, will evidently cause the hook to move both vertically and horizontally at the same time. The mechanism operating the two drums is shown in Fig. 8. There are two electric motors, M and N, one of which, N, drives the spur gears, G G, and with them, the bevel gears A A, of the two epicyclic bevel gear trains in the same direction. The other motor, M, drives the worm wheels, H H, in opposite directions, and with them the bevel gears C. C. The intermediate pinions of these trains revolve on the arms K K, which are keyed to the shafts of their respective drums, and the gears A, A, and C, C, are loose on their shafts.

It will be evident that with motor N stationary, motor M will

drive the drums in opposite directions, and so raise or lower the hook, as explained above. With M stationary, motor N will operate the drums in the same direction, and move the hook horizontally. As the motors can be reversed, or operated together at varying speeds, any desired combination of movements and speeds for the crane hook and its load can be obtained. The actions of these trains of gears is entirely similar to that of the others that have been explained in the previous illustrations.

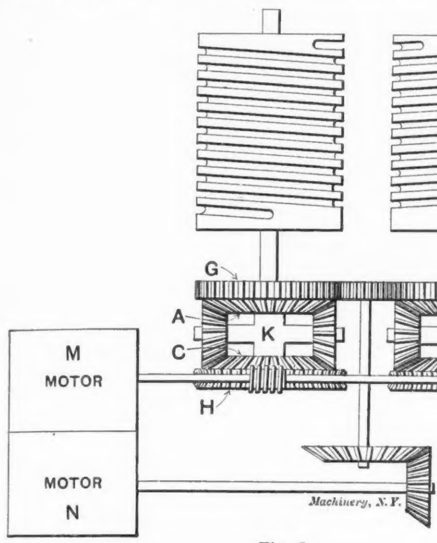


Fig. 8.

Water-wheel Governing.

The works of the Simonds Mfg. Co., Fitchburg, Mass., are operated by electric power, generated at a small station, in which the generators are driven by water power. The governing arrangement used at this station is simple and effective, and is shown in principle in Fig. 9. There is an auxiliary water motor which drives the bevel gear A by the belt D, while gear C is driven by belt E from a shaft operated by the main turbine. Both gears A and C are loose on their shaft, but the arm K, which carries gears B, B, is fast to the shaft. On the end of the shaft is a pinion, which gears in the rack that operates the turbine gate. The auxiliary motor, having no work to do except to drive its share of the gate-operating mechanism, runs at practically a constant speed, varying only with a rise or fall of the water level above the dam, which would be a small percentage of the total head of water. It may be assumed that this motor will run at a constant speed, and so the speed of gear A is practically uniform. The speed of gear C, however, changes with an increase or decrease of the load upon the turbine, and as it runs faster or slower than wheel A, the arm K follows it around one way or the other, as the case may be, and opens or closes the turbine gate, as required.

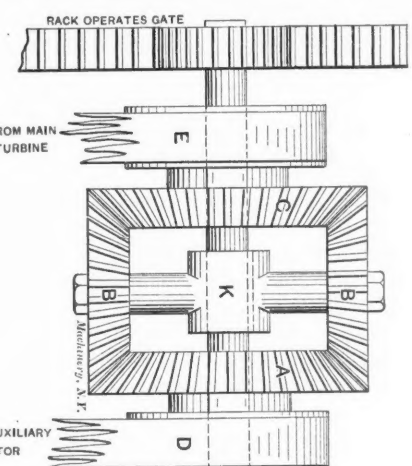


Fig. 9.

By way of contrast, in point of size of plant, it will be of interest to refer to another water-wheel governor, which, although entirely different, has epicyclic gearing operating on the same principle as the governor at the Simonds plant. This is the Faesch and Piccard governor, of Geneva, Switzerland, as used at the immense plant of the Niagara Falls Power Co. In this case there are two sets of epicyclic gearing, marked M and N, respectively, in Fig. 10. In each of these the gears A and C are loose on the shaft, as in the preceding case, but gears A, A', instead of being driven from without, are simply allowed to turn freely on the shaft with the arm K, or are kept from turning by the brake bands O, O'. The inside wheels C, C', are driven, one by a crossed belt and one by an open belt, from some source of power operated by the turbine. The brake bands are so arranged that when one tightens the other loosens its grip on its pulley. Both these bands are actuated by the shaft L, and the tightening of the bands takes place through a double ratchet mechanism, not shown, having two actuating pawls, one of which rotates shaft L in one direction and the other actuates it in the other direction. There is a fly-ball governor driven from the turbine, the duties of which are to put one or the other of the pawls into action when the speed increases or decreases. The result is that under such conditions one brake band is tightened and the other released, causing one of the wheels marked A to be held with a greater or less degree of friction, or to be kept from turning altogether, while the other one runs free. The arm K of the mechanism in which the wheel is held fast will begin to turn in the direction in which the wheel C turns—in one direction if the open-belt mechanism is operating and in the other direction if the crossed belt mechanism is operating—and the pinion on the end of the shaft will raise or lower the gate. This is a powerful governor, depending for its sensitiveness upon a regular fly-ball governor and for its power upon a belt which can transmit any desired amount of power.

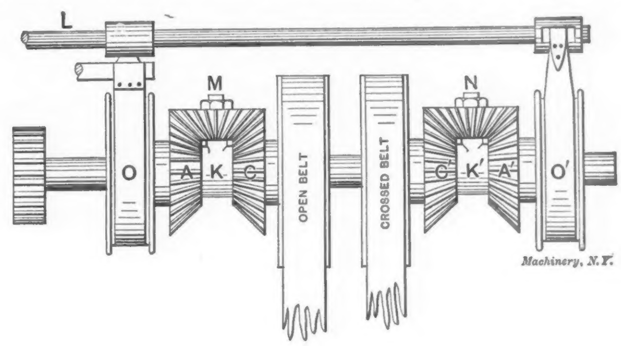


Fig. 10.

Cotton Spinning.

As a final illustration of epicyclic bevel gearing, there is shown in Fig. 11 an example of the differential motion used in cotton spinning. During the process of manufacture, the untwisted fiber, or roving, as it is called, is drawn out or attenuated by passing between successive pairs of rolls, which move, successively, at increased speeds. The fiber is then wound on bobbins

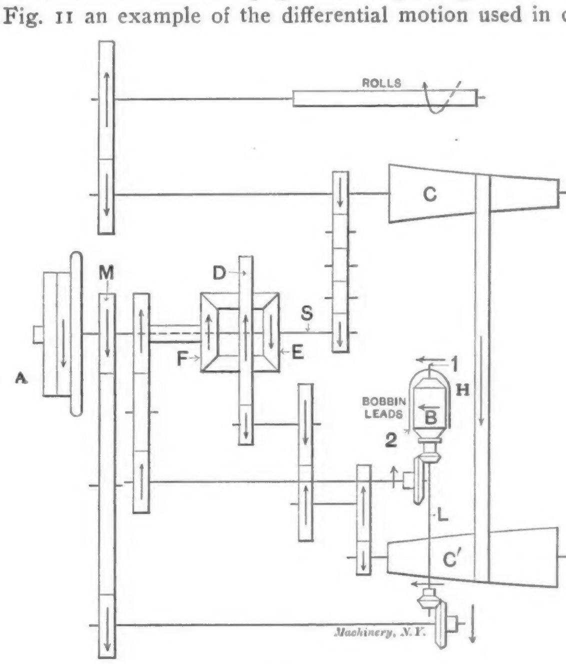


Fig. 11.

and at the same time given a slight twist. In Fig. 11 are the outlines of a "fly frame," designed for attenuating and twisting the fiber and winding it on bobbins.

Power is received by the pulley A, and is transmitted through the shaft S and the train of gears shown, to the cone C and the rolls, one of which is at the upper part of the diagram. The cone C and the rolls move at a constant speed and the roving is delivered by the rolls at a uniform rate of speed. On the shaft S is a bevel gear E, which is one of an epicyclic bevel gear train called in this case the "differential motion." The large gear D constitutes the arm of the train, since it carries the two intermediate bevel pinions, and is driven through a train of gearing by cone C', which is belted from cone C. Bevel gear F, which meshes with the pinions carried by D, is loose on shaft S, and is connected through gearing with the bobbin B. It is evident, therefore, that the speed of the bobbin depends first upon the speed of the bevel gear E, which is constant, and of the gear D, which may be varied by shifting the position of the belt on the cones. Any slight variation in the relative speeds of gears E and D will produce twice as great a variation in the speed of the bobbin.

The roving is wound on the bobbin in successive helical layers by means of the flyer H. This is supported by the spindle L, and is driven at constant speed by the gear M on shaft S. The roving passes from the rolls to the flyer, where it enters the top of the hollow spindle at point 1, and is threaded down through the left-hand arm of the flyer to point 2, where it emerges and goes to the bobbin. The bobbin rotates faster than the flyer, in this way laying on the successive coils, and as each coil is added the flyer travels up and down, so as to cover the whole bobbin with successive layers. As the layers are added, the bobbin increases in diameter and its speed relative to that of the flyer must be decreased, to prevent breaking the roving. This

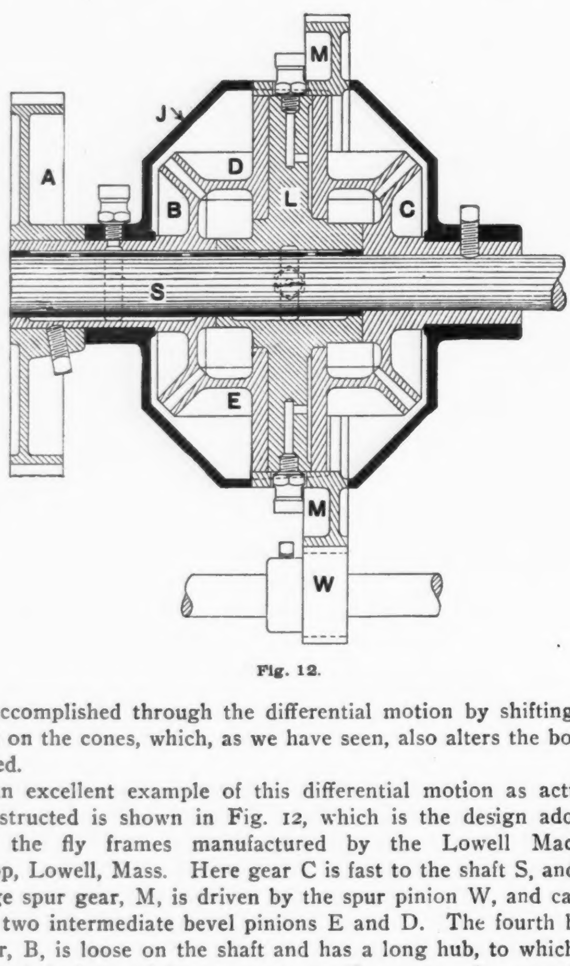


Fig. 12.

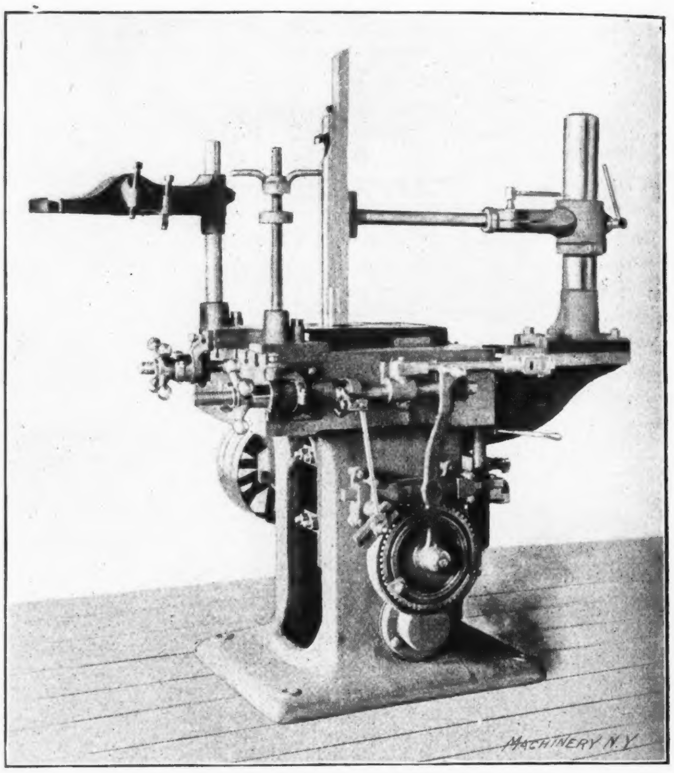
is accomplished through the differential motion by shifting the belt on the cones, which, as we have seen, also alters the bobbin speed.

An excellent example of this differential motion as actually constructed is shown in Fig. 12, which is the design adopted for the fly frames manufactured by the Lowell Machine Shop, Lowell, Mass. Here gear C is fast to the shaft S, and the large spur gear, M, is driven by the spur pinion W, and carries the two intermediate bevel pinions E and D. The fourth bevel gear, B, is loose on the shaft and has a long hub, to which the gear A is fastened by a set screw. To protect the parts from dust, there is a casing made in two parts, lettered J, one-half of which is fast to the hub of gear B and the other is fast to gear C. The parts that turn loosely on the shaft S are bushed with a composition liner and ample oil grooves are provided as indicated. This design is admirable, and is well worthy the study of any one who has to design an epicyclic bevel gear train.

NEW KEY-WAY CUTTER.

The accompanying illustration is of one of the Morton 20-inch stroke, standard key-way cutters, which embodies new and novel features. The construction is of the box column form, the column being heavily ribbed. The table is tongued and grooved and bolted to the top of the column, and is unusually heavy, so as to support the heaviest class of work when necessary.

The cutter bar is driven by a steel rack and steel pinion and the rack is located centrally with the bar, thereby overcoming any side strain. There is an adjustable guide that forms a bearing immediately underneath the table, no matter in what position the cross-head may be, and an extension guide which forms a bearing above the work. These bearings are rigid and easily adjusted.



Morton Key-way Cutter.

The machine gets its reciprocatory motion by the employment of open and cross belts, and has a quick return of three to one. The belt shifting is of such design as to throw the driving belt entirely from the tight pulley before the driver is shifted on and the special construction is such that the countershaft may be easily placed on the floor at the rear of the machine, or can be placed at an angle of 45 degrees or directly above the machine.

The stroke is adjusted by means of tappets on a circular disc and there is a reverse lever, whereby the motion of the cutter bar can be reversed at any part of its stroke. There is an auxiliary plate on top of the table, supplied with jaws which come up on either side of the cutter bar. These jaws are adjustable to the different sizes of cutter bars, and projections on them form a centering device by which the work is centered by the bore of the wheel or pinion being cut. This top plate is also provided with a micrometer adjustment, so that the machine may be set to cut key-seats of the given depth without the use of a rule. The taper and depth are all controlled by the feed hand-wheel, the graduations for taper being shown on the side of the top plate. It will plane taper either way. The machine is stopped and started instantly by means of a friction clutch provided with an automatic friction feed.

The cutter bars are flat and made of crucible, hammered steel. When worn on the back side, they can be planed and re-fitted at a slight expense. The smallest sizes of bars are fitted into a special chuck, by which they can be easily and quickly removed from the machine. The cutters are made on such a degree of angle as to cause the machine to take its cut without placing any more strain than is absolutely necessary on the working portions of the machine. The cutter bar is provided with an automatic relief for the return stroke. The machine can be fed

automatically in key-ways of any width, and when it comes up to the required depth the stop collar located on the feed screw makes the friction feed slip so that it is impossible for the machine to cut a key-seat any deeper than the automatic feed will allow it. This is a very desirable feature when key-seating steel and other work, as it leaves the operator entirely free to lubricate and attend to the cutter.

The special construction of the feed and other actuating mechanisms of this machine are such that the work remains stationary or fixed on the table, there being no sliding or other bearings which are liable to wear and lose their alignment when subjected to the strain of a heavy wheel placed upon the table.

There is an improved rapid-binding attachment by which one screw will successfully secure the work, and with it pieces of couplings, gears and other work of this nature can be very rapidly placed. The table is also provided with T-slots for securing the work which the binder is not adapted for.

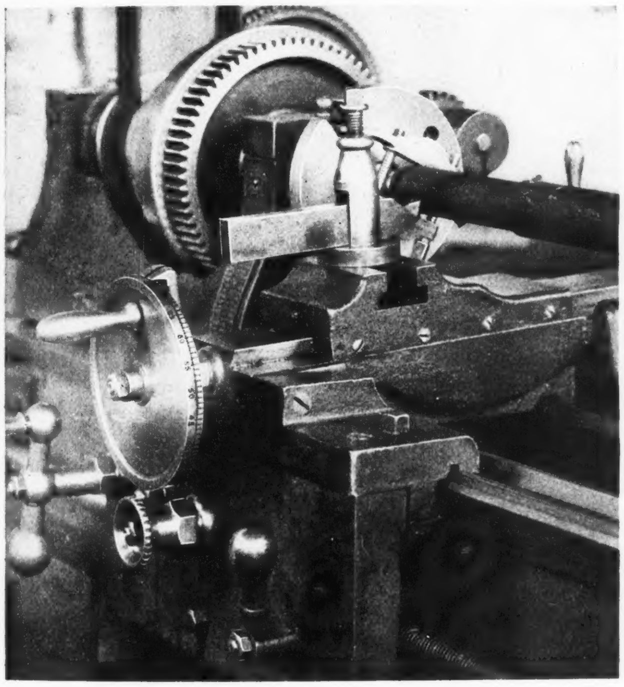
This machine is designed and built by the Morton Mfg. Co. at Muskegon Heights, Mich., who have given their special attention to the development and construction of key-seating machinery.

* * *

A CONVENIENT ATTACHMENT.

As our readers know, J. T. Slocomb & Co., Providence R. I., have made a specialty for a number of years of micrometer calipers for shop use. These calipers range in sizes from one to six inches, and are intended to be employed by workmen in their every-day operations.

To facilitate accurate work in the shop and convenience in obtaining sizes, J. T. Slocomb & Co. have used index dials on the



Dial for Micrometric Measurements.

cross-feed screw of their lathes similar to the one shown in the accompanying illustration. They have kindly furnished us with particulars about their construction and use, which we publish herewith:

"In fitting these dials to our lathes, we fitted the disc in the place of the usual ball crank. We turned a straight fit on the quill extending from the lathe apron and fitted to it the pointer, which is split and held by a binding screw. Our original intentions were to shift this point so as to start from even divisions, but we found, in use, that this is unnecessary. These dials greatly simplify some parts of the machinist business, when used in connection with micrometer calipers. We turn sizes for accurate fits by the most straightforward methods possible. There are no "cut and try" methods about it—simply round up the work and measure it with the micrometer, which shows how many thousandths there are remaining to come off; then by the reading on the dial the cutting tool can be adjusted to take off this remainder. There is in this case little chance for mistake and a great saving in time over the more ancient way.

"Although the most valuable feature of these graduated dials is in adjusting for sizes, still there are other uses. We use them exclusively for cutting threads instead of the usual screw-cutting stop, and find the advantage that the depths of cuts are accurately measured. Every one knows that most screw-cutting stops spring so badly that fine finishing cuts are difficult. As an example, in cutting, say 7/16" 14-P threads on short work, start in by taking .005 to each cut for about 6 cuts, then take .003 for 5 or 6 more, then finish by taking .001 or .002. as is required to make smooth threads.

"This is not so much like guessing as usual, and it gives a person a clear understanding of what the work will stand. Every piece of the same kind can be cut by running over the same number of times and until the tool has to be changed all will finish to exact size by the same reading on the dial, and the starting point will also be the same. The dial is also useful for adjusting for turning tapers. For testing truth of work by using a suitable tool, the dial can be made to show how many thousandths the work is out of true. For cutting recesses in inside work, places difficult to get at to measure, the tool can be adjusted to the same size on the end of work easy to get at, and then other sizes can be adjusted for it by the dial.

"There are also other uses that will readily suggest themselves to suit the work in hand. Of course, it is to be understood that a little judgment is required in handling. The feed screws on most machine tools are not very accurate, varying in inaccuracy up to as high as .006 to the inch, and so it would not be safe to place confidence in dial readings for long adjustments, when accuracy is required; and there is no occasion for this, as a general thing, for short readings will answer the purpose. Also it should be understood that some experience is necessary before the best results can be obtained.

"Of course, the dial must be graduated to suit the pitch of the feed screw. For an 8-P screw we use a dial 5 inches in diameter graduated in 125 divisions, in short lines, for thousandths. With every 5th line extended and numbered we also graduate one division on the pointer in ¼ thousandths, so one of these short divisions on the pointer reduces the diameter of the work ½ thousandths."

* * *

BRAINARD GEAR CUTTER.

There is no piece of work requiring more care than making index or dividing wheels for gear cutting machines and there is no mechanism to be found on machine tools of greater interest than that devised to automatically space the gear blank on which teeth are being automatically cut. The accompanying illustrations are from working drawings of the spacing device used on

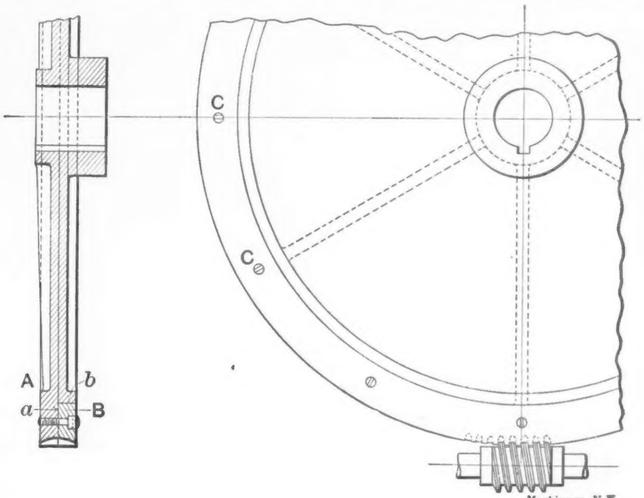


Fig. 1.

the gear cutters made by the Becker-Brainard Milling Machine Co., Hyde Park, Mass., who have kindly furnished the following description of the arrangement as well as of their method of making an accurate dividing wheel.

The essential feature of the mechanism is the worm wheel shown in Fig. 1. This wheel is built in two parts, the line of division being in the center of the rim, thus splitting the teeth

equally. One of these parts is the wheel proper (A), the other is a ring (B) let into the wheel so as to form half of the rim. The ring (B) is carefully turned, and the face (a) trued up on a face plate by scraping in the usual manner. The surfaces (a) and (b) are then accurately fitted into the wheel. The next step toward completion is the drilling and tapping of the holes (C). These holes must be so spaced that when the ring (B) is turned to bring one hole above any other in the wheel (A)

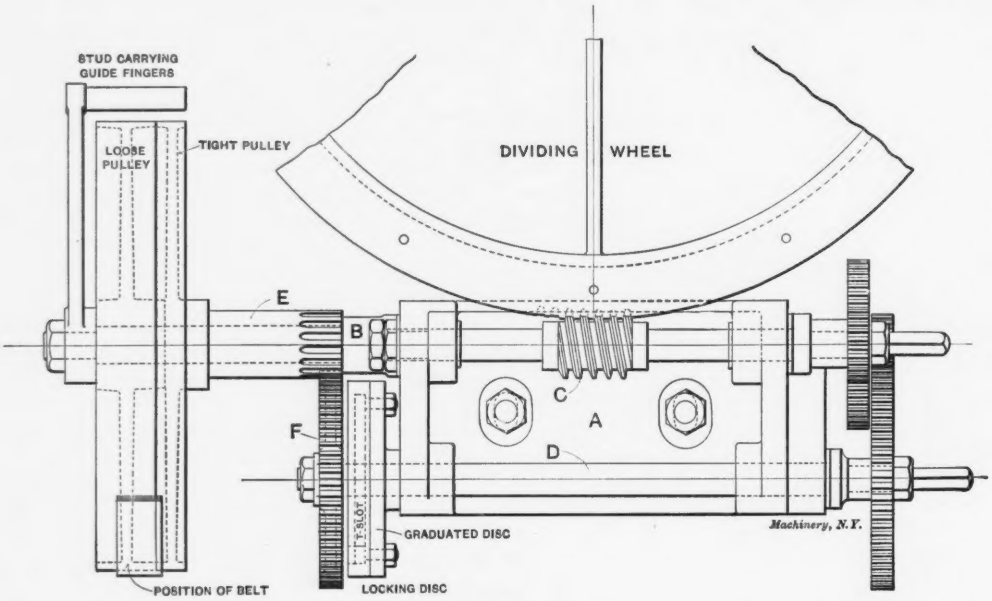


Fig. 2.

all the holes exactly coincide. Ring and wheel are now clamped together by the twelve machine screws, and the process of cutting the teeth begins.

A single cutter first roughs out the teeth—180 on a 36" gear cutter—leaving sufficient stock for the several finishing cuts taken by the hob, a cutter with teeth set on the same spiral as the worm which is to drive the wheel. The ring (B) is now turned around several spaces (six, for example, on the wheel A), is again secured to the wheel and a second cut taken. This process is repeated until a given hole in the ring has covered every other hole in the wheel and at the final cut all inequalities in the teeth at the time of the roughing cut are almost entirely removed. The finishing touches are given by examining the teeth under a microscope and scraping them to exact uniformity. In this way each dividing wheel is made ready to perform its important work.

The movement of the dividing wheel, which gives the necessary space to the teeth on a blank being cut, is brought about by a series of change gears whose general arrangement is shown in the elevation Fig. 2. A bracket (A) capable of vertical adjustment on the frame of the machine, holds the worm (C) in position with the dividing wheel. This vertical adjustment is designed to take up the very slight wear of the worm against the dividing wheel. Into this bracket is tapped a stud (B) which carries a loose pulley and a tight pulley keyed to gear (E). The position of the driving belt is fixed by guide fingers (adjustable if necessary), and is shown overlapping the tight pulley sufficiently to drive the train of gears during the interval of spacing the teeth, but not so far as to produce undue strain on the gears while locked for tooth cutting. Owing to this unique arrangement of the belt there is a constant pressure against the locking bolt, and when the tooth cutter has completed its cut across the gear blank, the forward feed of the dividing wheel is started on the instant of the release of the locking disc. It has been objected that this system of feed is not "positive," but the record of "not missed a tooth in fifteen years" is ample evidence that this arrangement is satisfactory and has the merit of extreme simplicity.

The locking disc, connected to the dividing pulley by gear E, consists of a graduated disc and the lock disc proper. On the circumference of the lock disc is a single notch, cut to receive the lock bolt, which is automatically withdrawn by the winding of a chain by one of the shafts of the cutter-driving mechanism. The bolt returns against the circumference of the lock disc, and prevents it from making more than one revolution, which corresponds to one tooth-space on the blank. Thus the number of teeth cut on a given blank is dependent upon the amount of feed given to the dividing wheel, and that is varied by inserting proper change gears between the locking disc and worm shafts. The graduated disc is clamped to the lock disc by means of bolts whose heads lie in a circular T-slot cut in the lock disc. This arrangement permits the gear blank to be turned to any position and the amount of change read in degrees on the graduated disc, without disturbing the locking mechanism or belting, by simply loosening the nuts on the outside.

* * *

NEW GERMAN LINER.

On July 13 the "Deutschland," the new liner of the Hamburg-American line, arrived at her dockage, next to the desolate space where the North German Lloyd wharves were located in Hoboken, N. J. This vessel is shorter than the "Oceanic," the largest ship afloat, but has the greatest engine capacity of any vessel. A sea speed of 23 knots is guaranteed and an average of over 22 knots an hour was made during the maiden voyage, eclipsing any similar record. This vessel, and the "Kaiser Wilhelm der Grosse," of the North German Lloyd, impress one with the advanced position that is now taken by Germany in naval architecture and marine engineering.

The dimensions of the "Deutschland" are: Length over all, 686 ft. 6 in.; beam, 67 ft.; depth, 44 ft.; net tonnage, 16,000 tons; and displacement, 23,000 tons. The engines a[illegible]rew of the quadruple expansion, six-cylinder type, [illegible]ective horse power. Steam is furnished by boilers [illegible] type, twelve double ended and four single ended, [illegible]ogether 112 furnaces. There are four groups of boilers, [illegible] in its own fire room, and each having uptakes connected with a separate funnel. The cylinders are of the following diameters: H. P. (2), 30.6 in.; first I. P., 73.6 in.; second I. P., 103.9 in.; L. P. (2), 106.3 in. dia and all of 72.8 in. stroke. The engines are designed with the two L. P. cylinders in the center, with the two H. P. over them tandem fashion, and the first intermediate at the forward end and the second intermediate at the after end. The new vessel is equipped in the most modern and luxurious manner, having comforts for passengers such as children's playroom, grill room, and gymnasium, in addition to those usually provided.

* * *

LOCOMOTIVES WITH ARMOR STEEL FRAMES.

The Pittsburg Locomotive Works have built two enormous locomotives for the Pittsburg, Bessemer and Lake Erie Railway, the frames for which are constructed of armor plate steel furnished by the Carnegie Company, which owns the road in question. These locomotives are thought to be the largest that can be constructed for operation upon a standard gage line. The boilers are 86 in. in diameter at the smallest ring, are constructed of 1 in. steel, and carry a working pressure of 225 lbs. per square inch. One of these locomotives is to be sent to the Paris Exposition.

* * *

The proneness of the average passenger car window to stick and resist raising when some ubiquitous gentleman essays to be gallant to the fair lady passenger greatly in need of fresh air, has been an overworked joke with the comic papers for a number of decades. That universal lubricant graphite promises, however, to relieve the ancient chestnut of some of its forcefulness in the future, as the practice of using it on the car window slides has been adopted by at least one railroad (the Lackawanna) with very satisfactory results.

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DOMESTIC EDITION.—ADVERTISING INDEX PAGE 19.

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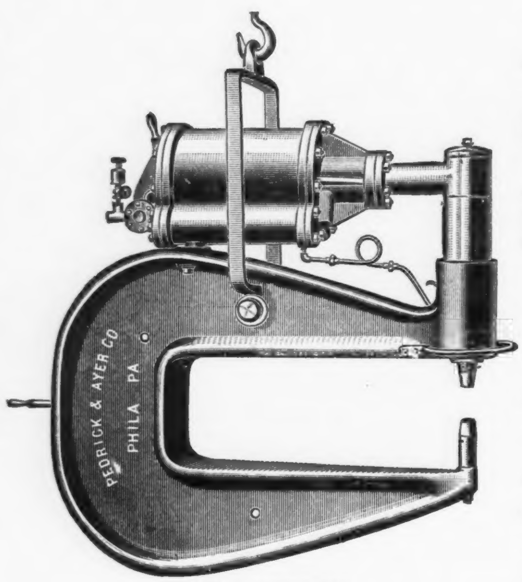

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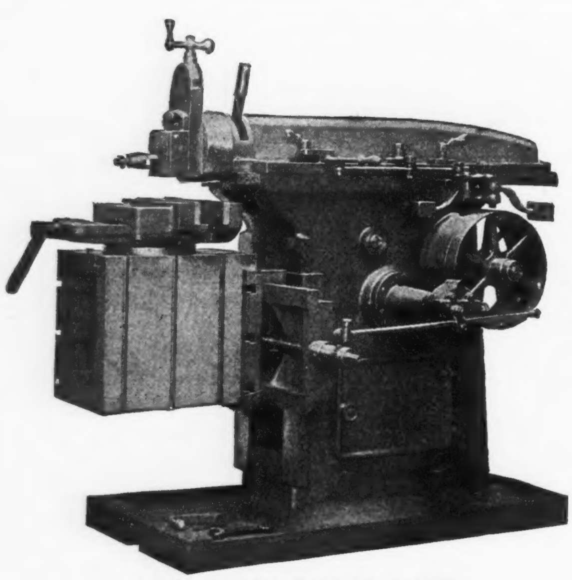

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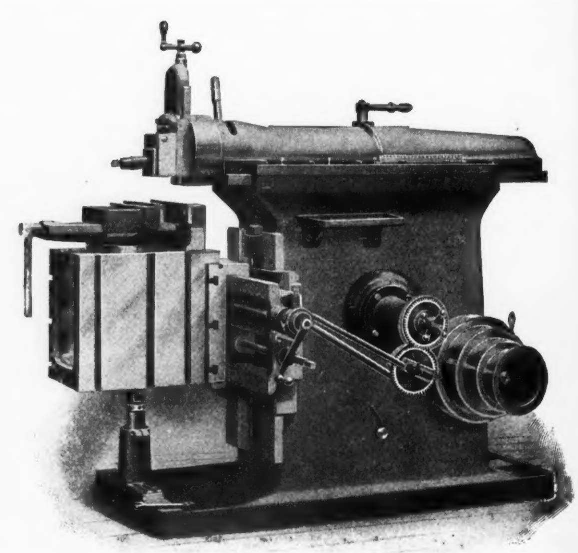

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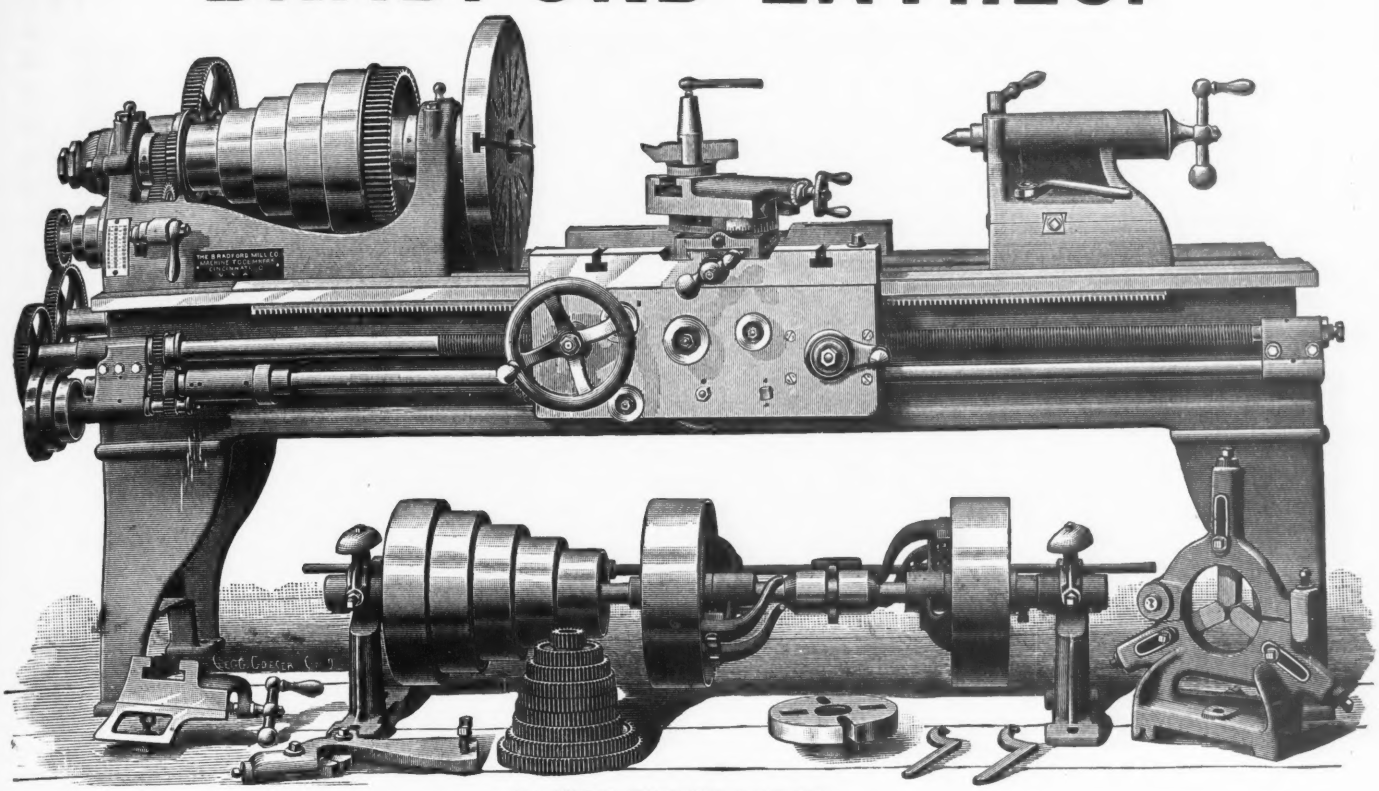

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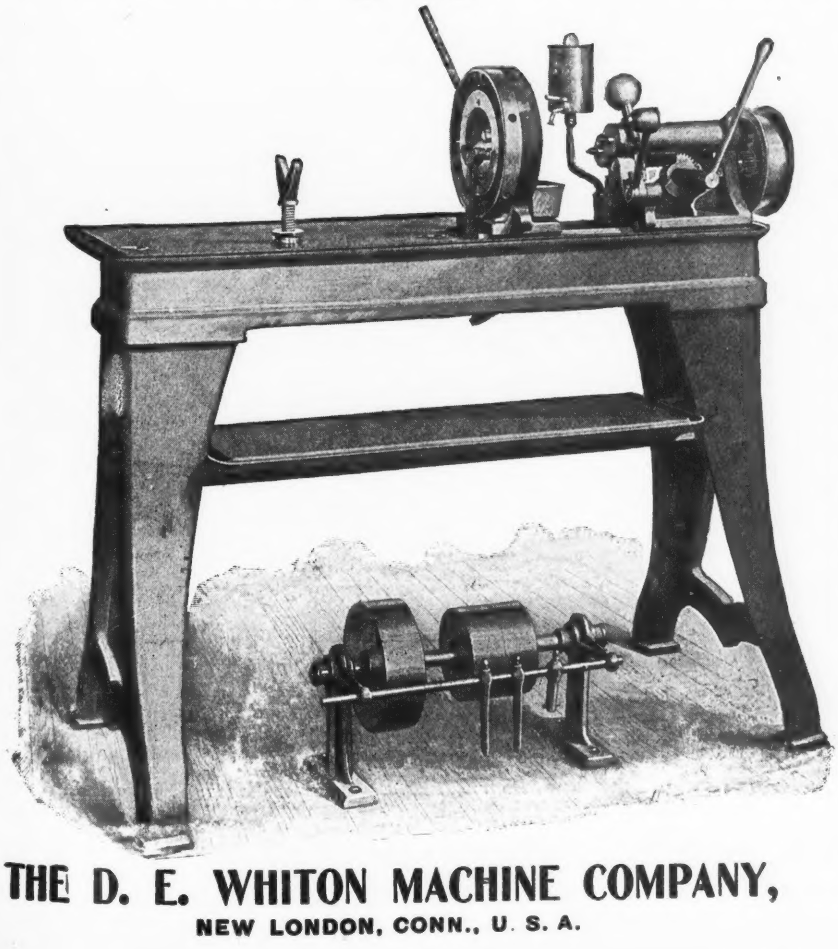

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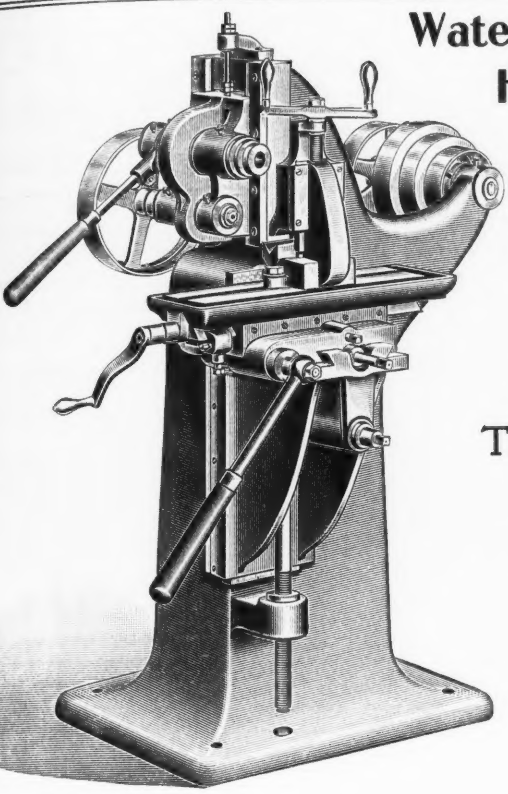

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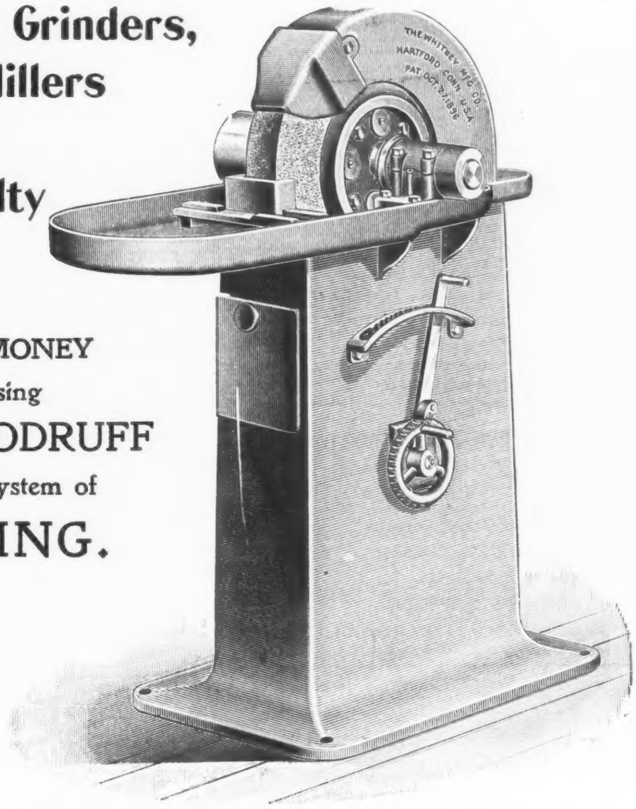

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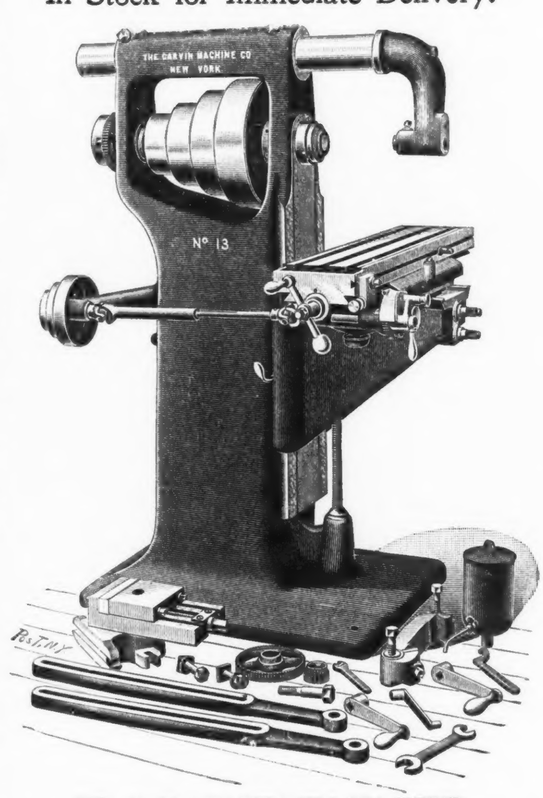

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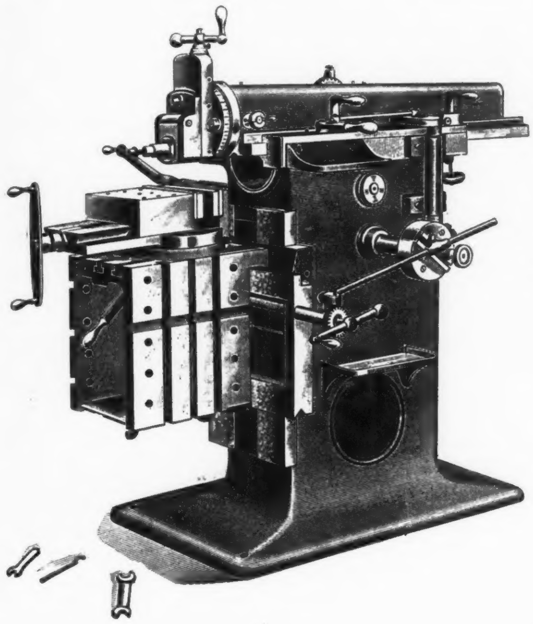

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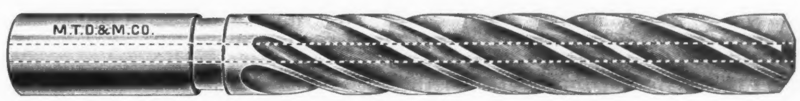

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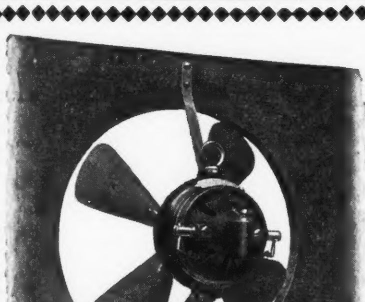

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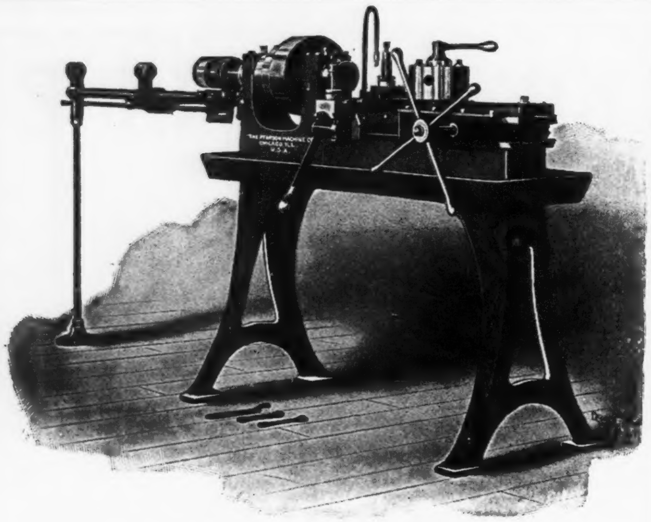

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Our New Screw Machine

DOES the work of several engine lathes and does more and better work than any other tool of the kind in the market. The design is entirely new and comprises every improvement that saves time and reduces cost in the work. Built in eight different sizes and capacities.

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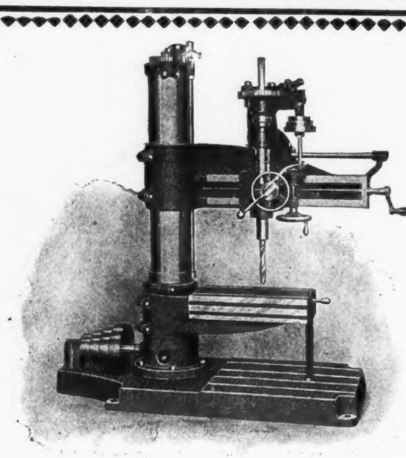

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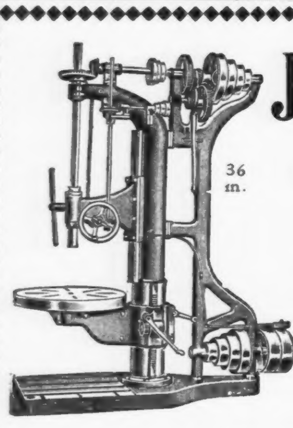

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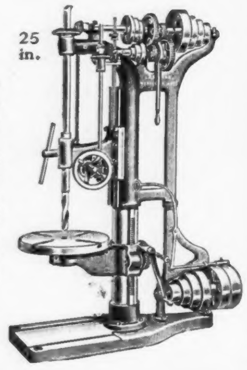

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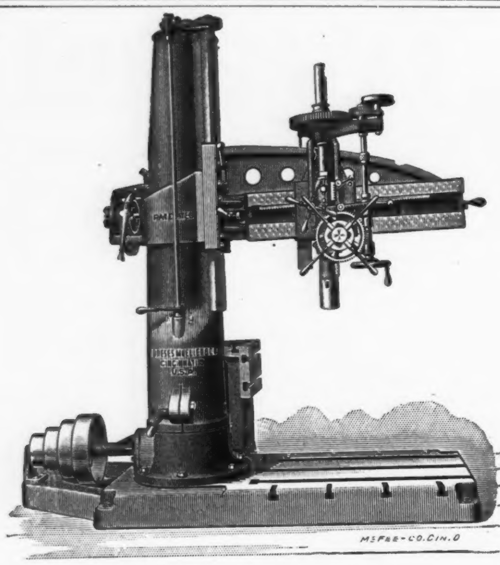

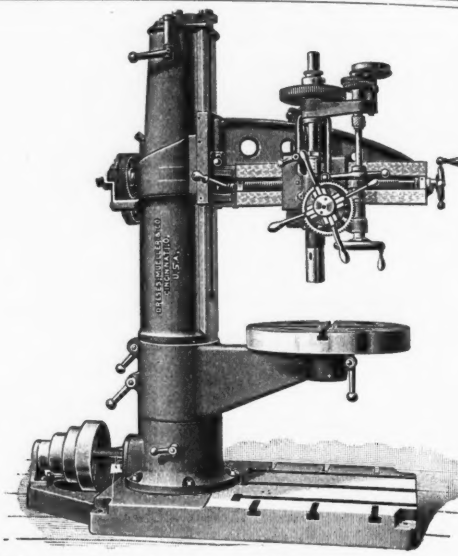

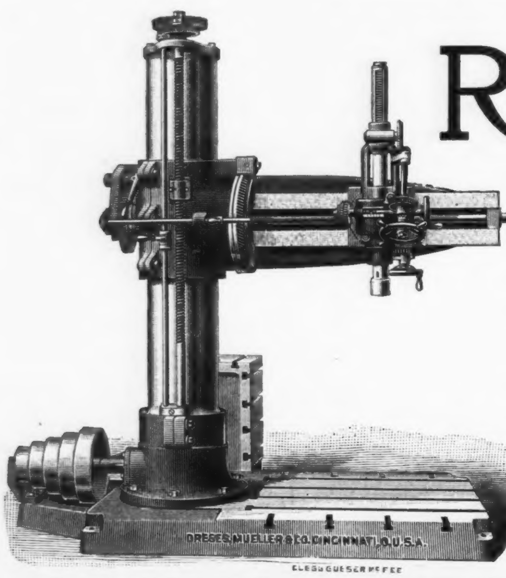


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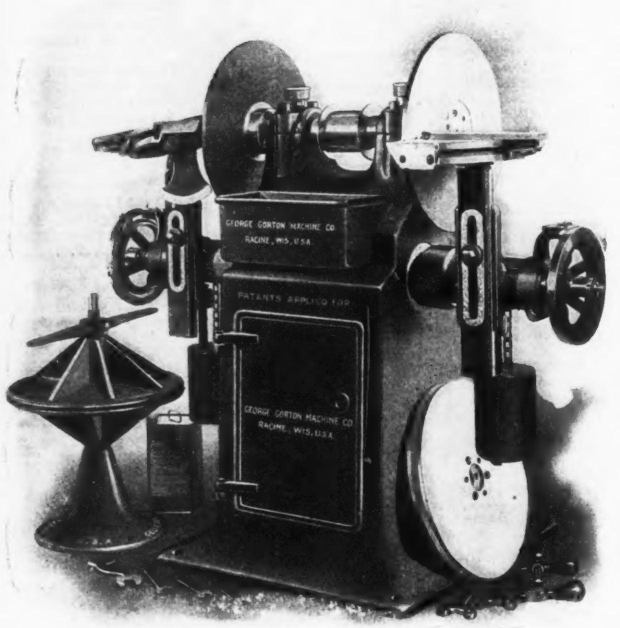

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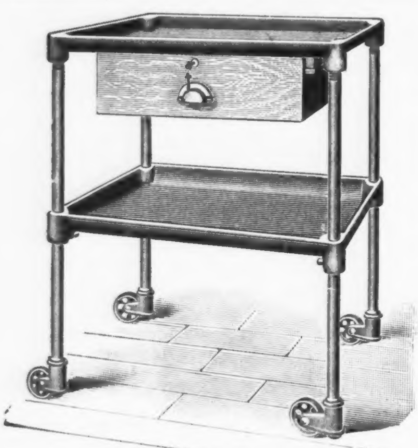

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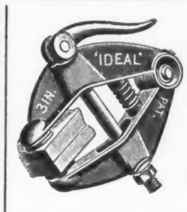

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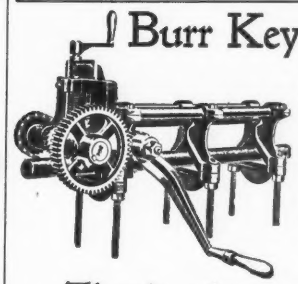

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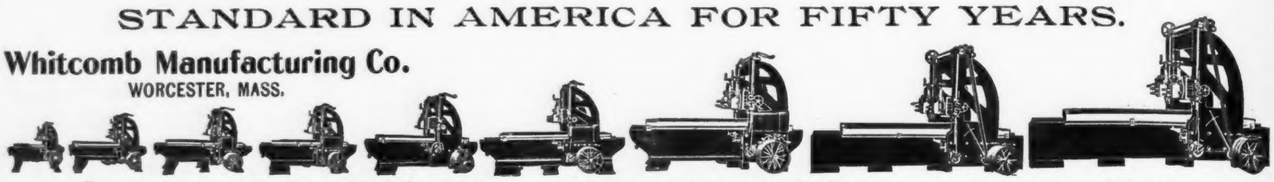

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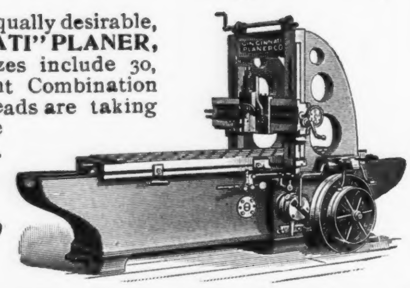

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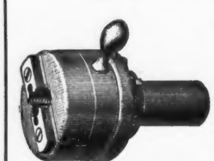

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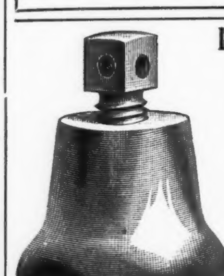

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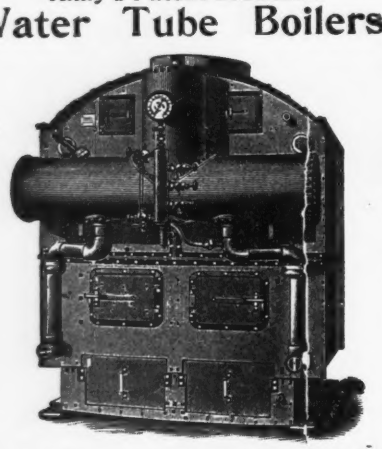

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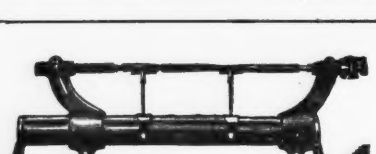

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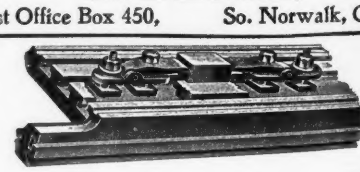

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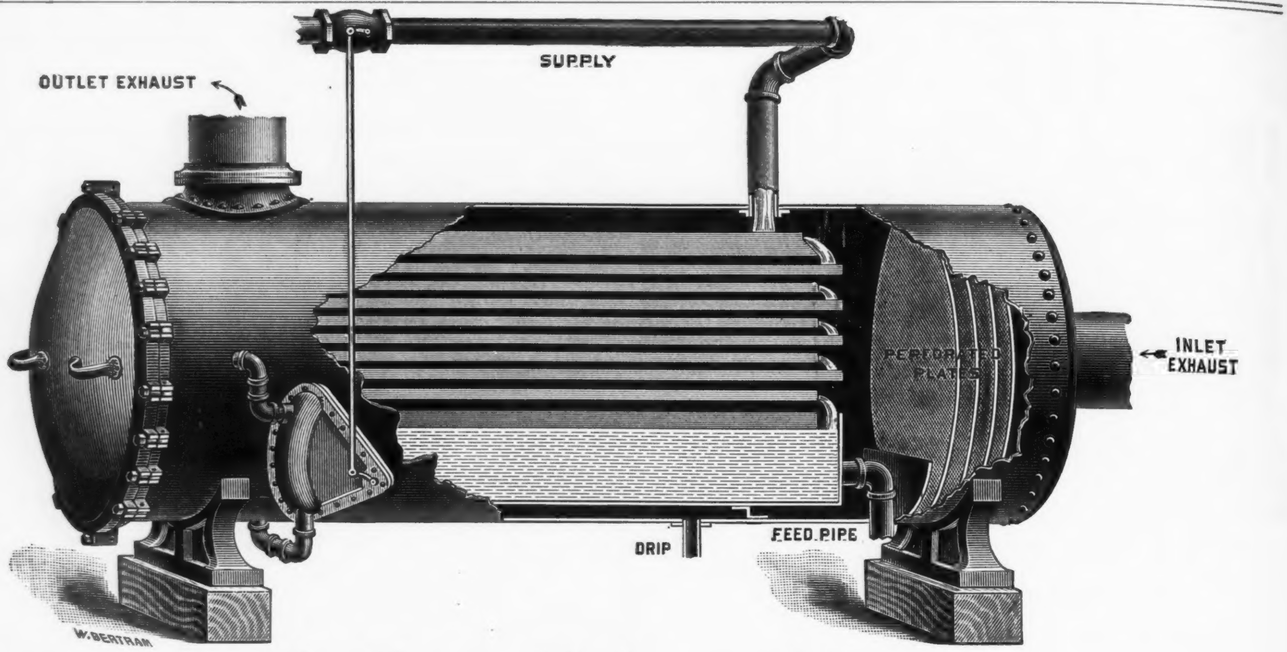

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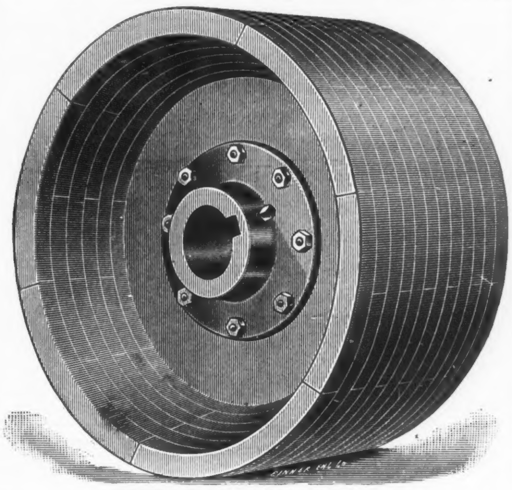

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New York Branch, 44 Dey Street. 'Phone 187 Cortlandt. Chicago Branch, 35 South Canal Street. Cable Address, Engrave. A. B. C. and Lieber's Codes.

THINKING DOLLARS

into your pocket is what you can do when you take your mechanical thinking apparatus down into your engine room and put it in operation on your steam plant.

Is your engine over or underloaded? In either case you are wasting money, and an Improved Robertson Thompson Indicator will decide the question and tell you a lot of other things about the operation of the steam in your engine cylinder.

Are you utilizing the waste heat from your exhaust steam to heat the water for your boiler? No? Burning more money right there. You want one of our Feed Water Heaters to help some dollars into your pocket.

Is your steam full of water when it enters the cylinder? If so, some fine summer day you may find your cylinder head blown out. A Hine Eliminator costs less than a repair job of this kind.

One more think on the Packing question, judiciously bestowed, will result in an order for some EUREKA—the best.

JAS. L. ROBERTSON & SONS,
212 Fulton St. New York.

Branches—Boston, Philadelphia.

TUBES SEAMLESS DRAWN BRASS and COPPER.

OFFICES:

BOSTON, 187 Milk Street.
NEW YORK, 20 Gold Street.
PHILADELPHIA, 543 The Bourse.
CHICAGO, 876 The Rookery.

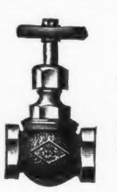
AMERICAN TUBE WORKS BOSTON. THE BOSTON TUBE TRADE MARK SEAMLESS DRAWN.

Sellers' Restarting Injector

A strictly first class machine at moderate cost. Perfectly automatic, has wide range of capacities, and raises water promptly with hot or cold pipes. Very simple, has few parts and is easily repaired. All parts interchangeable, made of the best bronze, and the workmanship is perfect. Send for special catalogue descriptive of this Injector.

JENKINS BROTHERS, Selling Agents,
New York, Boston, Phila. Chicago.

JENKINS BROS.' VALVES



are manufactured of the best steam metal, and are fully guaranteed. Why experiment with cheap valves? If you want the BEST ask your dealer for valves manufactured by Jenkins Brothers. Remember all genuine are stamped with Trade Mark like cut.

JENKINS BROTHERS, New York, Philadelphia, Chicago, Boston.

Dixon's Graphite Compound

FOR JOINTS AND SCREW THREADS.

Is far superior to red lead or other cements for making all pipe and joint connections whether steam, gas or water, as it makes a tighter joint and one that can be taken apart at any time with ease and without injury to pipe or tools.

Joseph Dixon Crucible Co.,

SEND FOR CIRCULAR AND SAMPLE. **Jersey City, N. J.**

DIXON'S PURE FLAKE GRAPHITE

Saves Horse-Power, Cools Hot Bearings, Prevents Friction, Increases the Lubricating Power of all Oils and Greases, and is indispensible to every Engineer and Machinist in hundreds of ways.

FOR SAMPLES AND FULL INFORMATION ADDRESS

Joseph Dixon Crucible Co., Jersey City, N. J.

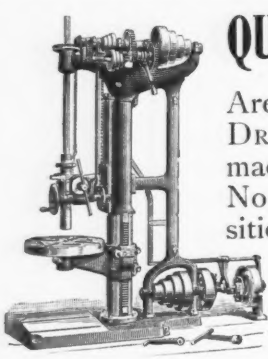
The Billings & Spencer Co., Hartford, Conn., U. S. A.
Drop Forgings and Machinists' Tools.

Ball Pein, Straight Pein, Cross Pein, Boiler Makers' and Horse Shoers' Hammers.

Drop-forged of best tool steel. Size, shape and "hang" of the handles is correct.

The attention of the Trade is called to the superior line of Hammers made by this Company. Hammers sold with handles only.

EVERY HAMMER STAMPED WITH OUR TRADE MARK. B



QUALITY and QUANTITY COMBINED

Are found in the new CINCINNATI UPRIGHT DRILLS. This is a strictly business producing machine. Each part is right and for a purpose. No fancy talking points—only facts and necessities. Will you have a catalogue—free?

CINCINNATI MACHINE TOOL CO.

Western Ave. & Frank St., Cincinnati, Ohio, U.S.A.

Established 1830.

LORING COES & COMPANY,

Difficult **Hardening** and **Tempering** a specialty.

Originators of the "Pyro-Calcic" Hardening Process.

Worcester, Mass.

It's a Nicholson.

That's all you need to know about a File.

It has

Many Imitators, but No Competitors.

FAMOUS FOR TEMPER AND CUT.

NICHOLSON FILE CO.,
PROVIDENCE, R. I., U.S.A.

THE WATERBURY FARREL FOUNDRY AND MACHINE CO.,
WATERBURY, CONN., U.S.A.

Designers and Builders of Machinery for Rolling and Slitting

SHEET METAL

and Machines for Punching, Cupping, Drawing, Stamping, Embossing, Spinning, Trimming, etc. Also Rivet Machines and other

AUTOMATIC MACHINERY

J. M. ALLEN	President.
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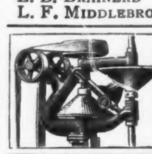
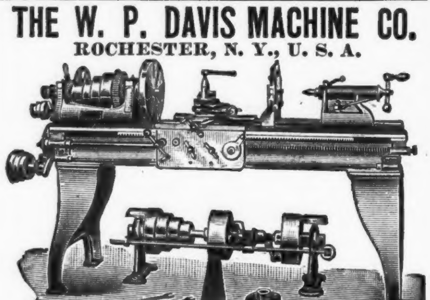


SENSITIVE DRILL PRESS
TOOL ROOM & GENERAL USE.
THE KNECHT BROS. CO.
WRITE US CINCINNATI, O. U.S.A.

THE W. P. DAVIS MACHINE CO.

ROCHESTER, N. Y., U. S. A.



BUILDERS OF **FINE LATHES.** From 10 to 30 inch swing. *Send for Catalogue.*

FRESH FROM THE PRESS.

Gas Engine Construction, by Henry V. A. Parsell, Jr., and Arthur J. Weed, M. E., published by Norman W. Henley & Co., 132 Nassau street, New York. 296 8vo pages, illustrated. Price, $2.50.

This is a book intended for amateurs, and as such we can commend it. The authors state, "There are many good books on the gas engine, its theory and designs. There are various books on mechanical processes, turning, planing, filing, etc.; books, too, on how to make model boats, engines, locomotives, and a host of mechanical toys, but no really practical book telling how to make one machine and to make it well. It is with the above points in view that the authors have endeavored to give the amateur in this book, first, a broad and general knowledge of various forms of gas engines; second, a full and concise description of the making of a gas engine by practical shop methods, avoiding makeshifts and bungling; third, a set of modified rules for designing similar engines, followed by a list of books and periodicals useful to the student."

The book tells at the beginning a few of the important facts, simply stated, about the theory of the gas engine. At the end is a brief chapter on design, which, while it contains rules convenient for reference, would hardly form a sufficient guide to the design of a gas engine. The balance of the book is taken up with many half-tone illustrations of patterns and of the processes of construction for a half horse-power gas engine. It shows how a mechanic would perform each one of the machine shop operations required in building and erecting the engine. While most of this instruction would be an old story for a mechanic, it is what an amateur, who usually lacks a knowledge of shop work, needs.

Horseless Vehicles, Automobiles and Motor Cycles, by Gardner D. Hiscox, M. E. Published by Norman W. Henley & Co., 132 Nassau street, New York. 458 8vo. pages, illustrated. Price, $3.00.

A brief history of the automobile is given in this work, which is followed by descriptions of the numerous automobiles and devices for the same that have recently been brought out or placed on the market.

The book is non-technical—that is, it does not enter into theoretical considerations, nor does it treat of the engineering features of automobile construction and design. The industry of automobile construction is not sufficiently advanced, probably, to enable a strictly technical book of any value to be written upon this subject.

The author has collected from the mechanical press, from patent reports and from information furnished by builders or obtained through his own personal efforts, over 300 sketches and illustrations, which, with descriptive matter accompanying them, part of which is evidently clipped, constitute the bulk of the work. The division of the subject matter into chapters makes it possible to refer to any particular subject desired. The chief value of the book is that it shows what has already been done in this industry. It would afford but little assistance other than this to the designer. There are a list of automobile patents and of builders of automobiles at the end of the work.

Textile World's Official Directory of the Textile Manufacturers in the United States for 1900. 446 pages. Published by Guild & Lord, publishers of the Textile World, Boston, Mass. Price, linen covered edition, $2.00. Price, cloth bound edition, $2.50. Part I is a directory of the textile manufacturers of the United States, arranged by states and towns, giving full data of each mill, etc. Part II gives a list of the different agents and buyers of textile fabrics. Part III is a directory of the dealers in raw materials and textile stock. Part IV contains a number of valuable tables for mill use, such as comparative yarn tables, reed tables, weight of yarn per yard of cloth table, knitting gages, sizes of yarns for knitting machines, etc.

MANUFACTURERS' NOTES.

The Winkley Co., successors to F. D. Winkley & Co., manufacturers of dust proof oil-hole covers, have removed their business from Madison, Wis., to Hartford, Conn.

The American Machinery Co., Grand Rapids, Mich., inform us that their exhibit of Oliver Wood trimmers at the M. M. & M. C. B. convention at Saratoga Springs, New York, was one of the interesting exhibits on the grounds. The shaving off of chips leaving a perfectly smooth end on the wood trimmed was a source of surprise and interest to those unfamiliar with Oliver wood trimmers. An attractive little souvenir booklet entitled "Saratoga Chips," of which we received a copy, contained chips similar to those shaved from the wood at the exhibit.

Mr. J. W. Oliver, president of the company, has left for a three months' trip abroad, where he will visit the Paris Exposition and the larger cities of England and the Continent, the trip being, we are told, a combination of business and rest.

The thirteenth annual convention of the officers and agents of the National Cash Register Co., Dayton, O., has recently been held and was made an event of unusual importance in the history of the company. Representatives were present from different parts of the world at the expense of the company, and the proceedings were attended by the factory employes and their families. The business sessions were interspersed with periods of recreation. Altogether it was a gala event for the company and for the city of Dayton.

The Saginaw Mfg. Co., Saginaw, Mich., have opened a branch house at No. 35 South Canal street, Chicago, Ill. Mr. G. A. Gilbert is manager of this branch, and a complete stock of Gilbert's wood-split pulleys will be carried.

The Bliss Chester Co., Providence, R. I., has recently been organized for the manufacture of sheet-metal stampings, screw-machine products and metal novelties. Mr. M. E. Bliss, of the firm, was formerly with the Mossberg Mfg. Co. Mr. John Chester was connected with the Waterbury Brass Co., and later was superintendent of the Providence Gas Burner Co.

The Philadelphia Machine Tool Co., Philadelphia Pa., call the attention of all interested in the physical testing of materials to their recently added department for the construction of machinery and apparatus employed in such testing. Mr. Joseph W. Bramwell, recently engineer and manager of Riehle Bros. Testing Machine Co. and editor of the "Digest of Physical Tests," will have special charge of this department.

H. W. Johns Mfg. Co.'s new navy brand asbestos fire felt covering has been adopted for the pipe work in the Albany Capitol building of this State. The contract amounts to over $4,000. This company, we are told is making great headway in the way of improvements in the manufacture of their materials. They were also successful in securing the pipe and boiler covering work for the new addition of the Manhattan Hotel, 42nd street and Broadway, New York City.

Harris Machinery Co., Washington avenue, S. E., Minneapolis, Minn., handle all kinds of new and second-hand machinery. We are informed that they will supply anything in the line of engines, boilers, heaters, pumps, piping, shafting, belting, new or second-hand. They have now on hand nearly 1,000 new thresher belts at very reasonable prices.

Mr. Geo. Salzman, who has been tool maker and foreman for the Ball Bearing Co. of Boston, Mass., is now holding a position of foreman of the shops of M. C. Hammett, Troy, N. Y., while Mr. Clarence W. Rowe, general foreman for the Ball Bearing Co., has received and accepted an offer of an important position with the Beloit Iron Works, Beloit, Wis.

Brown & Sharpe Mfg. Co., Providence, R. I., announce that their works will be closed from August 6th to the 18th, inclusive, for the annual vacation and repairs. During the vacation the office will be kept open as usual, and orders for machine tools and small tools, listed in their catalogue, will receive the same attention as at other periods of the year.

We are informed that Mr. A. B. Holmes, who has been connected with the Standard Pneumatic Tool Co., Chicago, Ill., since its organization, has been appointed assistant manager, and will be located at the Marquette Building, Chicago.

The company have also opened offices at Pittsburg, Pa., where their Mr. Wm. Jennings will have complete charge. The president, Mr. Edw. N. Hurley, will sail for Europe on the 30th inst., for the purpose of establishing works in Germany and France for the European trade. Mr. Hurley will also be in attendance at the Paris Exposition.

ADVERTISING LITERATURE.

We have received the following catalogues and trade circulars:

The S. Obermayer Co., Chicago, Ill., and Cincinnati, O., general catalogue, No. 30, of foundry supplies. Air hoists, cranes, molding machines, blowers, scales, cupolas, and the many other machines and appliances required in the foundry are listed, as well as the supplies that are required in every day work.

Wilmarth & Morman Co., Kalamazoo, Mich., illustrated catalogue of the "New Yankee" drill grinder. A complete line of grinders is listed which will grind all sizes of drills from No. 60 to 5" in diameter. A water grinder and electrically-driven grinder are also made by this company.

The International Correspondence Schools, Scranton, Pa. Two circulars, one containing a large number of home indorsements of this organization and its work; and the other, an interesting story of young men who have fitted themselves for good positions through the work of these schools.

The Gisholt Machine Co., Madison, Wis. A handsomely illustrated catalogue showing both front and top views of their machines. The latter views show the various tools in position in the turret for turning of a varied character. There are also many illustrations of parts that have been made on these machines. The catalogue will prove of interest to the mechanic as well as to the purchasing agent.

The Pratt & Whitney Co., Hartford, Conn. Pocket-size catalogue which illustrates and describes completely the many tools turned out by this firm. There are over 300 pages, and the catalogue will prove handy as a reference book.

The J. M. Carpenter Tap and Die Co., Pawtucket, R. I. Pocket catalogue, No. 13, of tools for cutting screw threads. The manufacturers write that they will be pleased to send this catalogue to any who wish it, and it will be found to contain about everything pertaining to the subject of taps and dies.

The Dwight Slate Machine Co., Hartford, Conn. New pocket-size catalogue of sensitive drills and special machinery. The drills are made both single and multiple spindle, and other tools listed are marking machines, pinion and gear cutters, rack cutter, cender grinder, bolt-head milling and screw-slotting machine, cutter and drill grinder, tapping machine, besides numerous small tools and appliances.

Scranton Corundum and Emery Wheel Co., Scranton, Pa. Illustrated catalogue of emery and corundum wheels with safety flanges. A number of grinding machines are also listed.

Beaman & Smith, Providence, R. I. 6" x 9" standard catalogue of milling and boring machines. Milling machines for the heaviest character of work with one or with several spindles are illustrated, and the boring machines include those of the usual horizontal type, besides many floor boring machines for both medium and heavy work. Numerous special machines of this character are included in the catalogue. The designs show much originality and the machines apparently are capable of a wide range of work.

The B. F. Barnes Co., Rockford, Ill., have sent us a catalogue of a 20" upright drill which is of new design and is made either with or without back gears.

Leighton & Wisner, Waltham, Mass. Circular of a new parallel ruler attachment for drawing boards. This ruler is designed to take the place of T-squares, and will rule either horizontal or inclined lines.

Stark Tool Co., Waltham, Mass. Catalogue of machinists' bench lathes, which are designed for both lathe work and milling, and which have numerous attachments for special work. A variety of other small tools are also listed.

CONTENTS FOR AUGUST.

The Meriden Machine Tool Co., Meriden, Conn. A striking circular with advertisements of the forming lathe made by this company, written in imitation of different styles of advertisements used by several well-known manufacturers of popular goods. Like all the circulars of this company, it is out of the ordinary and is interesting reading.

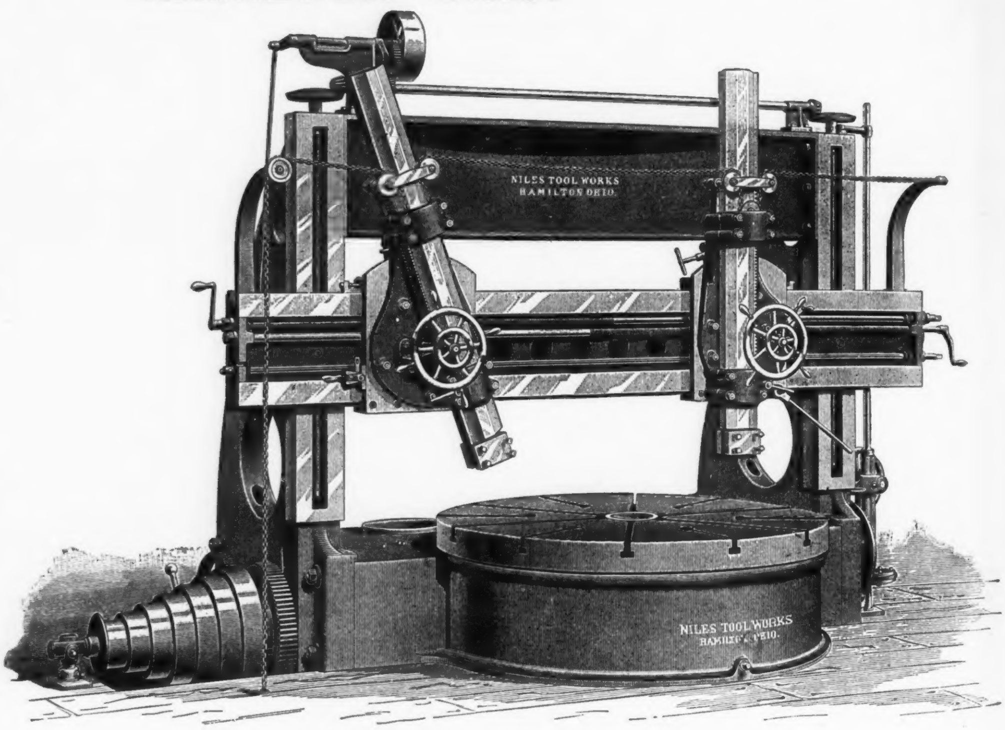
NILES TOOL WORKS CO.

HAMILTON OHIO.

MACHINE TOOLS AND RAILROAD SUPPLIES.

OFFICES:

NEW YORK: 136-138 Liberty St.
PHILADELPHIA: 21st and Callowhill Sts.
BOSTON: 65 Oliver St.
CHICAGO: Western Union Building.
PITTSBURG: Carnegie Building.
ST. LOUIS: 615 N. 4th St.
LONDON: 23-25 Victoria St., S. W.



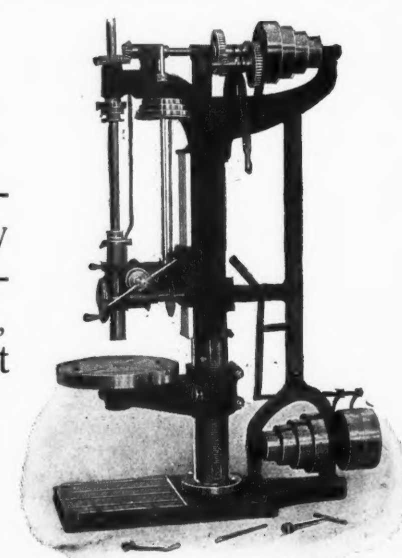
8 FT. BORING AND TURNING MILL.

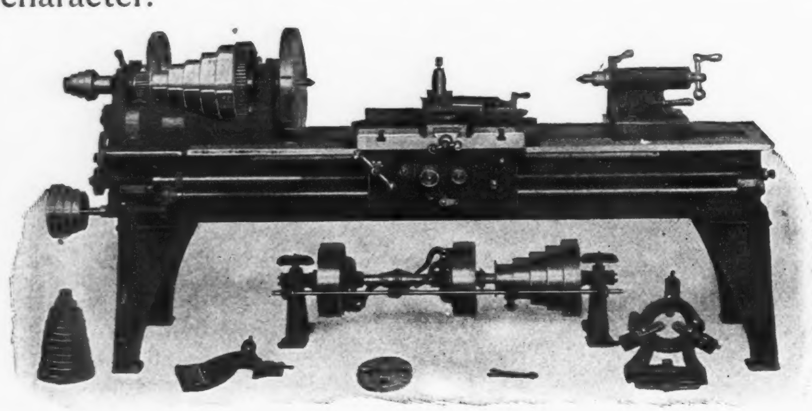
AGENTS:

PARIS: H. Glaenzer & Perreaud.
COPENHAGEN: V. Lowener.
STOCKHOLM: Ak. V. Lowener.
BRUSSELS: Adolphe Janssens.
JOHANNESBURG: Sheriff, Swingley & Co.
HELSINGFORS: Werner Hult.
ROTTERDAM: Van Rietschoten & Houwens.

THE HAMILTON

Lathes and Drill Presses are guaranteed to give satisfaction—if not found to be as represented, they may be returned at our expense. In design these machines are of the most improved and modern type, and the workmanship throughout of the highest character.





Drill Presses in the following sizes—12 in., 16 in., 20 in., 21 in., 24 in., 25 in., 32 in., 36 in., 40 in., and 44 in.

Engine Lathes—14 in., 16 in., 18 in., 21 in., and 25 in.

Radial Drills—76 in. and 110 in.

ILLUSTRATED CIRCULARS MAILED ON REQUEST.

THE HAMILTON MACHINE TOOL CO., MILLIKIN AVENUE, HAMILTON, OHIO, U.S.A.

THE GARVIN MACHINE COMPANY OF NEW YORK HAVE THEM IN STOCK.

Hamilton is 35 minutes from Cincinnati, via C., H. & D. R. R. Trains at short intervals. Visitors always welcome.

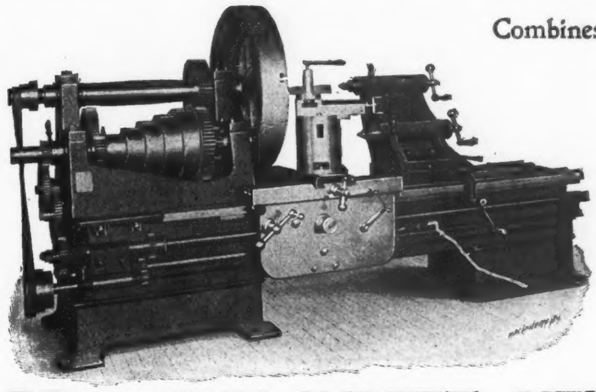
McCABE'S PATENT DOUBLE SPINDLE LATHE

Combines two complete Lathes in One

A 26-INCH SWING Back geared 11 to 1 for doing the common range of work.

A 44-INCH SWING Triple geared 22 to 1 or with Geared Face-plate 66 to 1 for doing the heaviest classes of work up to the full swing.

Swings as much over the carriage (39 inches) as in regular 54-in. lathe.



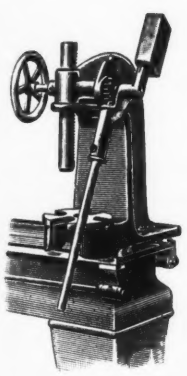
Has Hollow Spindle 2⅛in. hole and WIDER RANGE of SPEEDS, FEEDS and thread-cutting capacity than any regular style Lathe.

Adapted for all classes of work, both large and small, and costs but little more than an ordinary size lathe.

Send for catalogue and see the list of shops that have them.

J. J. McCABE, 14 DEY STREET, NEW YORK.

Wanted: Adverse Criticism—Experience



We have received a large number of very nice letters from our satisfied customers telling us of the advantages of the Greenerd Arbor Presses. We have received a larger number of checks paying for presses sent on approval, without any word good or bad, and we have also received a few (too few) letters from our customers telling us how to improve the press. These letters have had our best attention, and in nearly every case they have resulted in a decided benefit to us. They have certainly been cheerfully received, and we want more.

We want you to tell us how the press you have could be improved to do your own particular class of work better, or how to change the press so it would become even more popular in the shop.

What are the disadvantages? Where are the weak places?

NAPOLEON SAID:—"Tell the bad news first: the good can wait."

Awaiting an early reply, we are, Yours for progress,

EDWIN E. BARTLETT, 308 Atlantic Ave.. Boston, Mass., U. S. A.

Lifts on the Return Stroke.

The Challenge Power Hack Saw has a positive feed on the forward stroke, but the blade is automatically relieved on the return stroke, thus preventing dragging over the work. The Machine is also provided with adjustment for sawing to a depth, which permits it to be used for SLOTTING as well as CUTTING OFF.

SAWS METAL UP TO 6 INCHES.

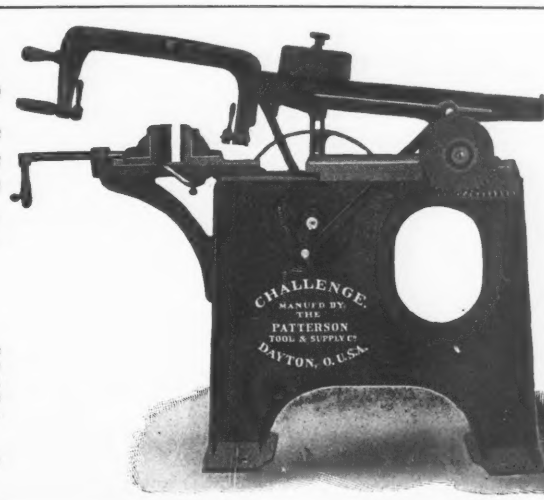
Price, including six saws, $50. Write for circulars.

Worcester, Jan. 6, 1900.

THE PATTERSON TOOL & SUPPLY CO., Dayton, Ohio.

GENTLEMEN:—I have now used your Challenge Power Hack Saw long enough to convince me that you have the best Power Saw that I have ever seen. The friction device to relieve the saw on the back stroke and also to put pressure on the cutting stroke, is so simple, yet effective, that one wonders why this has not been thought of before. I use the saw for quite a variety of work other than cutting up stock, but find it especially useful in slotting work.

Yours truly, The Geo. Burnham Co., Per F. R.



The Patterson Tool & Supply Co., DAYTON, OHIO, U. S. A.

IRON & WOOD-WORKING MACHINERY

U·BAIRD MACHINERY CO.

High Grade, Labor Saving

Machine Tools and Machinists Supplies.

123-125 Water St., Pittsburg, Pa.

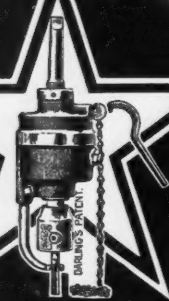
MACHINERY (TRADE MARK)

We have a large stock of new and second-hand machinery.

Send for prices and particulars....

Catalogue on application.

"STAR" TAPPING ATTACHMENT



60 Hours to 3 Hours

represents the difference in time between tapping holes by hand and using a "Star" Tapping Attachment on a small job by one of our recent customers. A larger job would show even a greater difference—You are not obliged to use the "Star" Tapping Attachment every hour to make it pay. The "Star" Tapping Attachment is suitable for Drilling, Tapping and Stud Setting. Automatic. Fits any Drill Press. No Reverse Belts required. Friction and Positive Drive. Chuck securely holds any drill, tap, etc.

No. 1 Taps 1-16 to 5-8 inch.
No. 2 Taps 1-16 to 1 inch.

Fully guaranteed. Sent on 30 days trial.

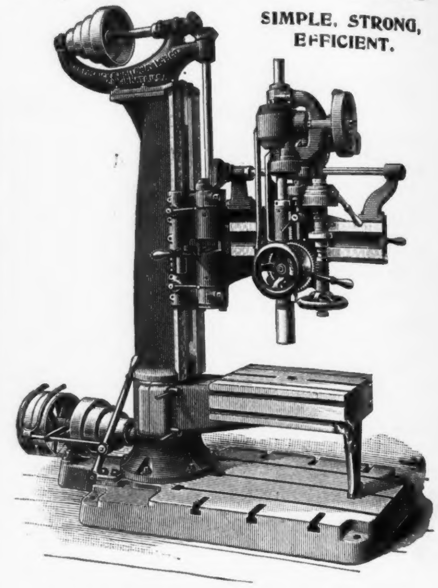
Circular "D" tells all about the "Star" Tapping Attachment. Shall we send it?

Seneca Falls Mfg Co.
330 Water Street
Seneca Falls, N. Y., U. S. A.

CHARLES AUSTIN BATES N.Y.

Radial Drills

SIMPLE, STRONG, EFFICIENT.



SEND FOR CIRCULARS GIVING DETAILS

The Fosdick & Holloway Machine Tool Co.
CINCINNATI, OHIO, U. S. A.

Clean Accurate . . . Iron and Brass **Castings.**

AMERICAN MACHINE & FOUNDRY CO.,
Hanover, Pa., U. S. A.

Do You Want Them?

J. R. DUFF'S HAND DRILLER

STYLE A IN USE.

For Bit Braces. Chain Attachments and Screw Feed.

This time and labor saving Tool can be quickly applied, works easily and drills metals to 1 inch hole. Well finished, strongly made and moderate in price. Three styles, A, AA and B. Send for prices and full description.

DUFF MACHINE CO.,
8 Western Ave.,
LOWELL, MASS.

FORGINGS

Steel Gear Blank. 4½ lbs.

OF EVERY DESCRIPTION

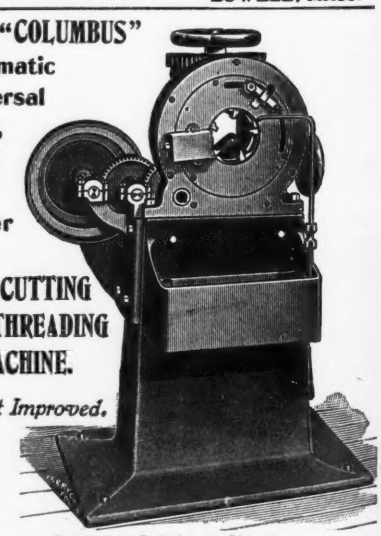
For Tools, Parts of Machines, Etc.

Send us sketch or patterns for estimate.

WYMAN & GORDON,
230 BRADLEY ST., WORCESTER, MASS.

The "COLUMBUS" Automatic Universal Feed, Hand and Power PIPE-CUTTING and THREADING MACHINE.

Latest Improved.



Send for Catalogue No. 5.

COLUMBUS MACHINE CO., *223 W. Broad St., Columbus, O.*

Pipe Threading and Cutting Machinery....

This engraving shows our Portable Hand Pipe Threading and Cutting Machine, with standard adjustable quick opening and closing die head, and improved cutting-off knife. Wide range of work and quick changes from size to size of pipe.

SEND FOR CATALOGUE 5.

THE MERRELL MFG. CO.
601 Curtis Street, Toledo, Ohio, U. S A.

EUROPEAN OFFICE, Fairbanks Co., 16 Great Eastern Street, London, E. C.

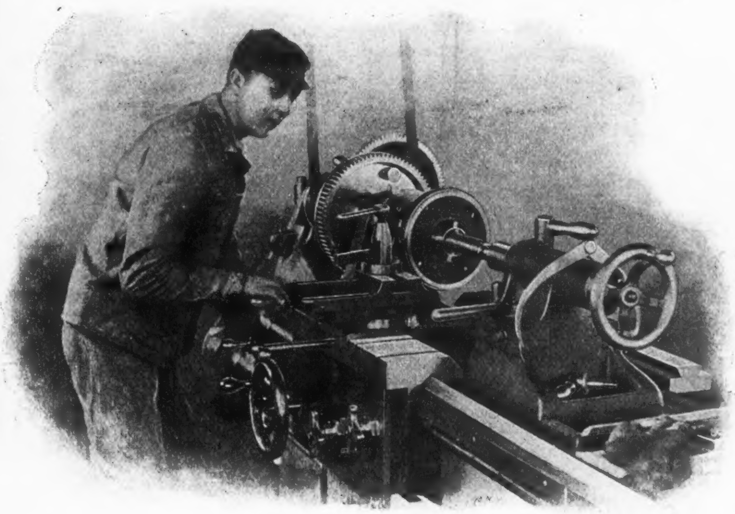
SPLIT SAFETY COLLARS

Write for prices and discounts.

IRA B. SMITH, 70 Main St., Bristol, Ct.

This man is using a Nicholson Expanding Lathe Mandrel.

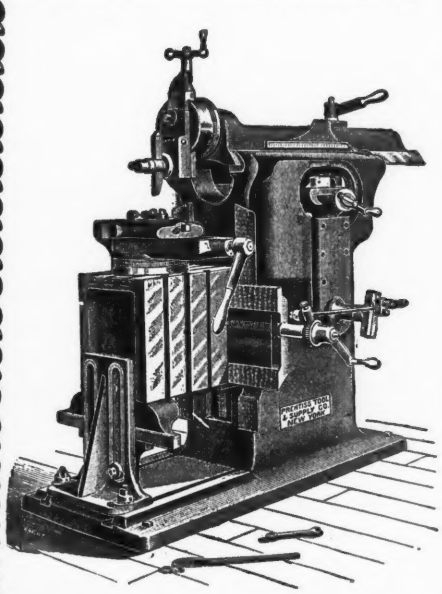
He is not the only one that knows a good thing when he sees it. Write for our new book, "Mandrel Talk," and you will find "there are others."



Set of Nine, from one to seven inches.

W. H. NICHOLSON & CO., WILKSBARRE, PA., U. S. A.

C. W. Burton, Griffiths & Co., London.
Adolphe Janssens, Paris.
Schuchardt & Schutte, Berlin, Cologne, Vienna, Brussels, Stockholm, St. Petersburg.



Prentiss Crank Shaper with extension base and knee support. Made in six sizes, 14, 18, 20, 22, 24 and 28 strokes. Write for full particulars.

Metal Working Machinery.

PRENTISS TOOL and SUPPLY CO.

115 Liberty St., NEW YORK, U. S. A.

Cable Address, Prenco.

Send for Complete Stock List.

Correspondence Solicited.

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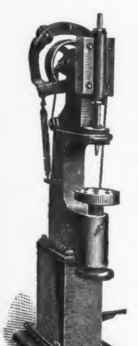

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Our Wire Straightening and Cutting Machines will soon pay for themselves. Estimate what it costs per day to have wire cut for you and compare with the price of our machines.

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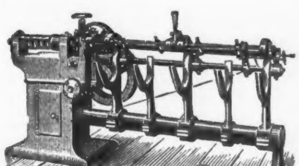

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NEW WORCESTER Universal DRILL GRINDER.

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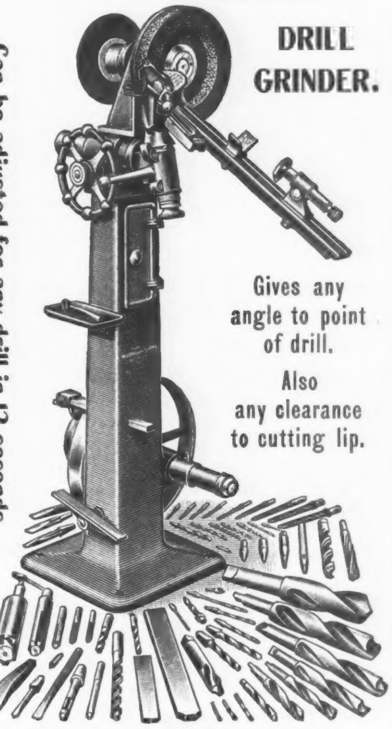

Gives any angle to point of drill.

Also any clearance to cutting lip.

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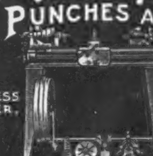

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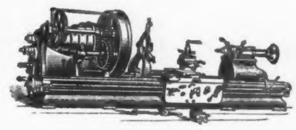

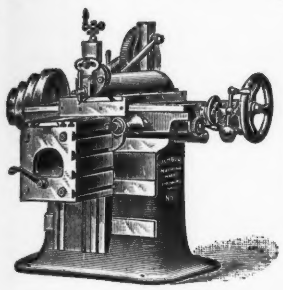

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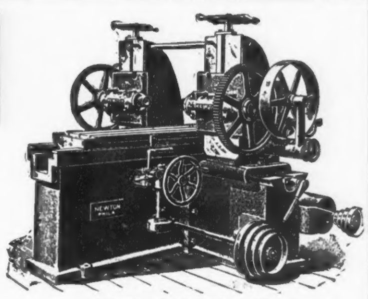

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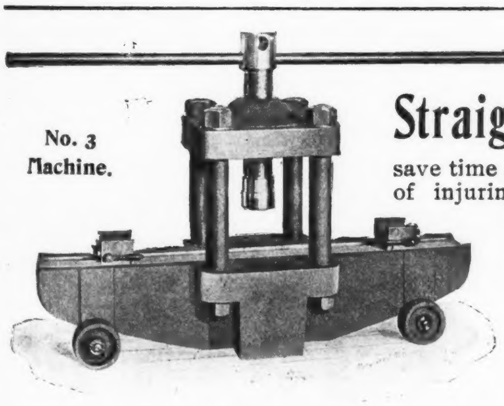

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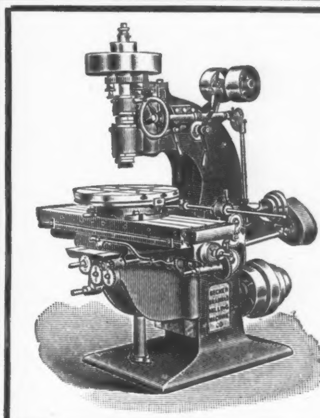

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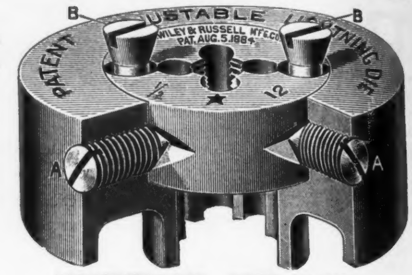

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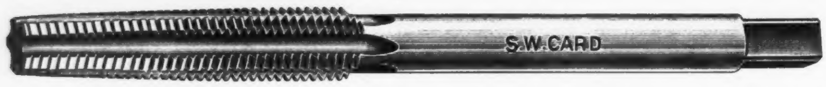

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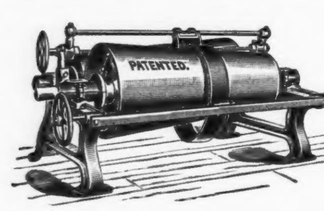

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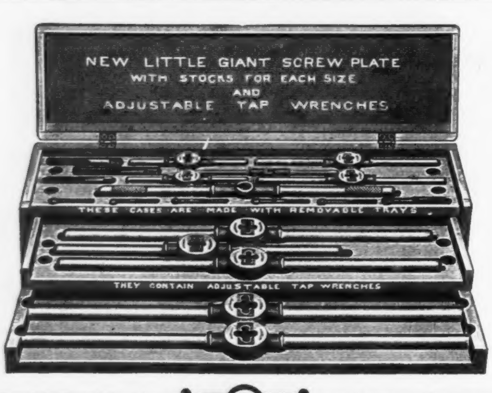

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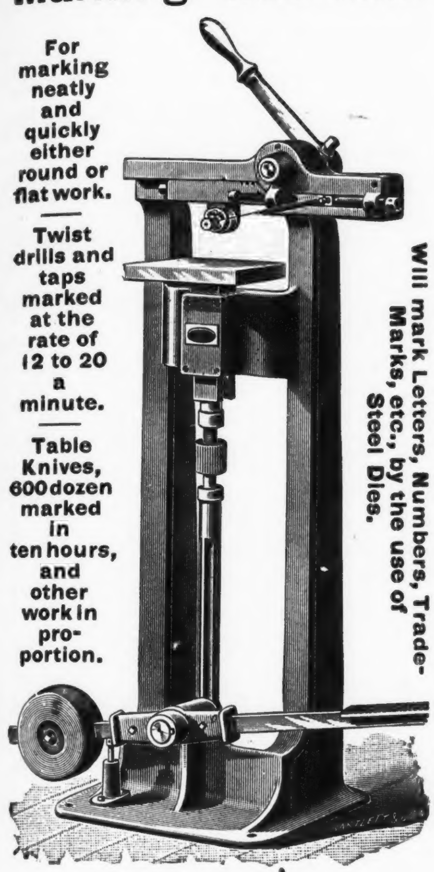

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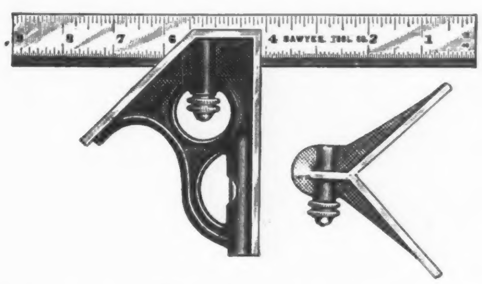

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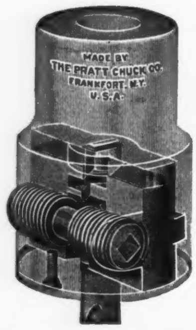

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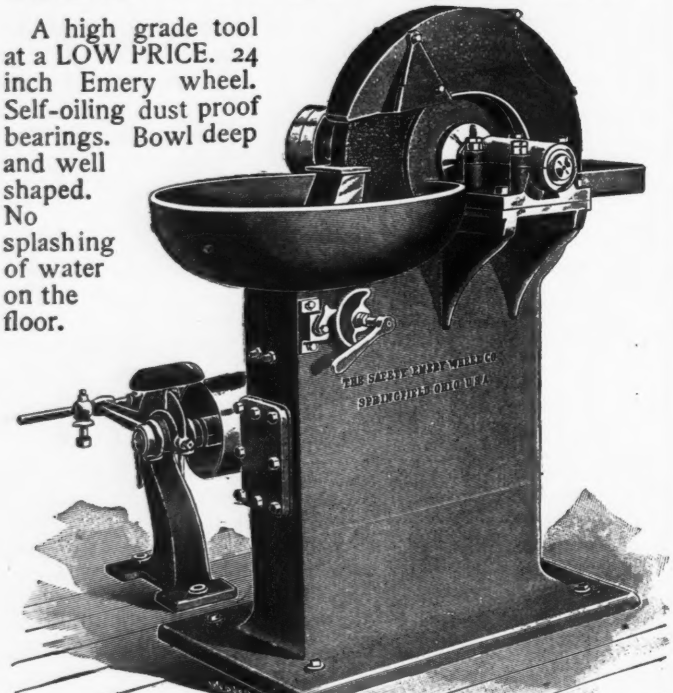

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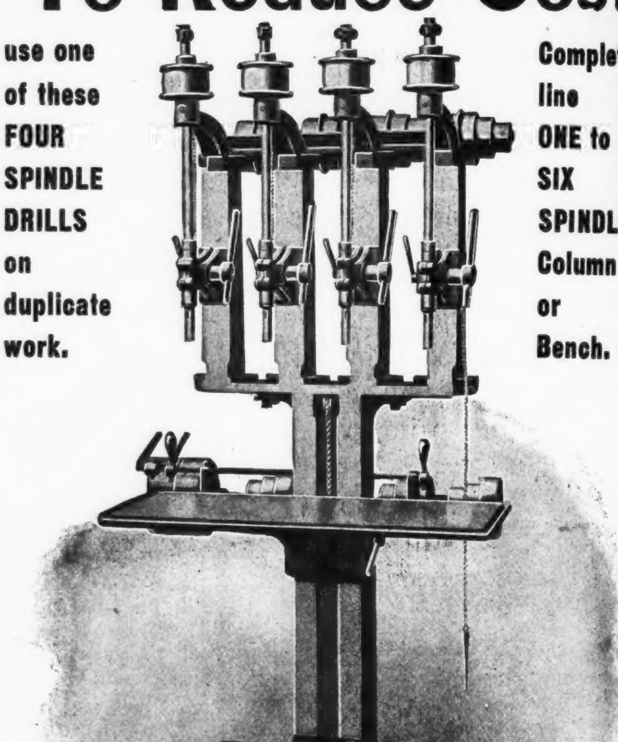

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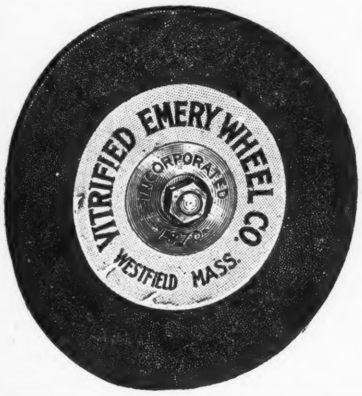

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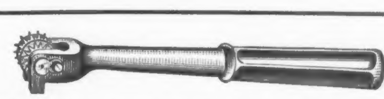

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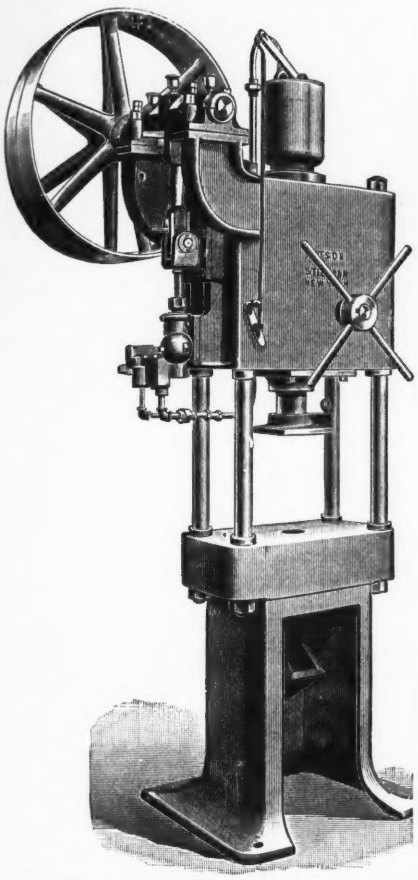

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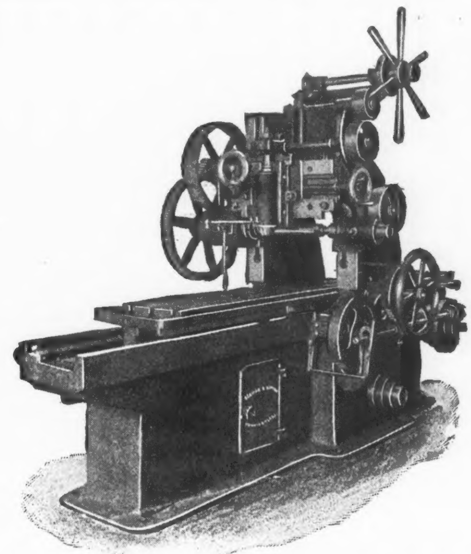

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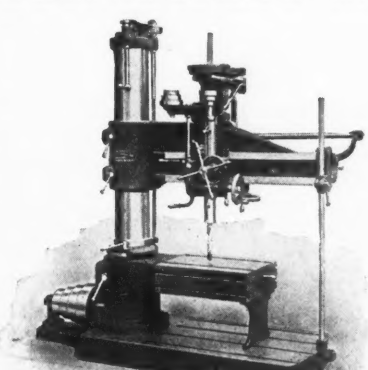

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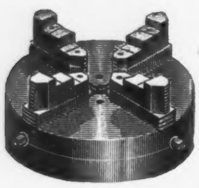

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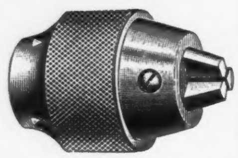

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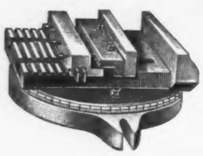

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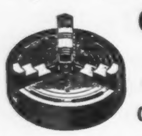

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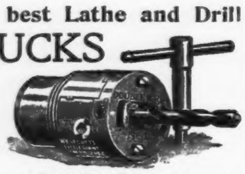

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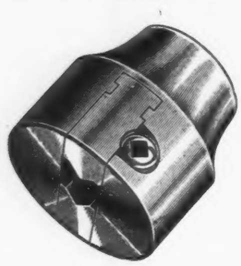

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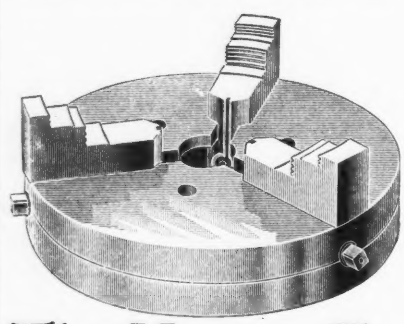

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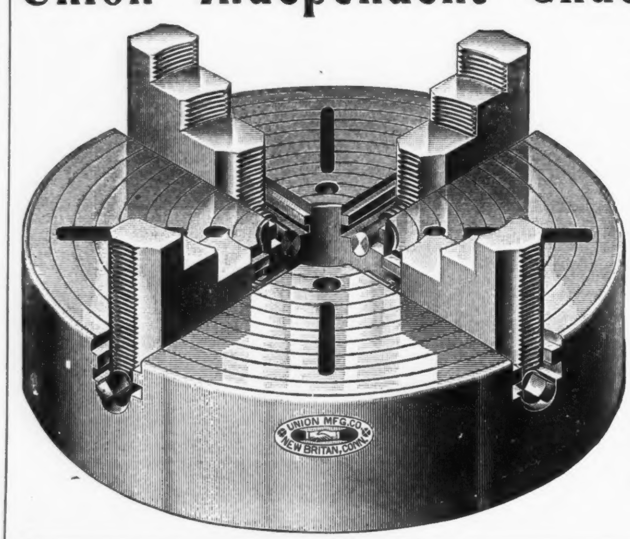

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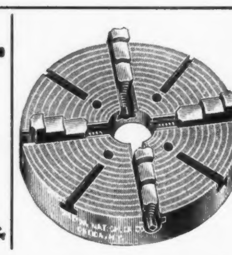

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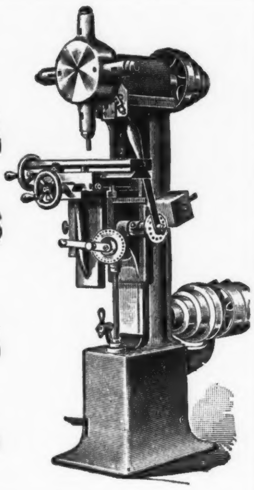

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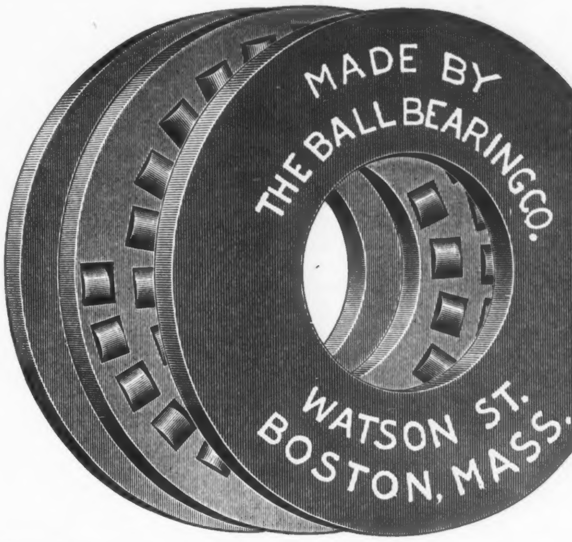

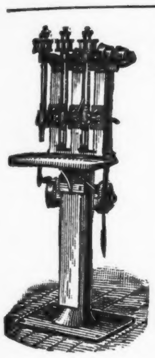

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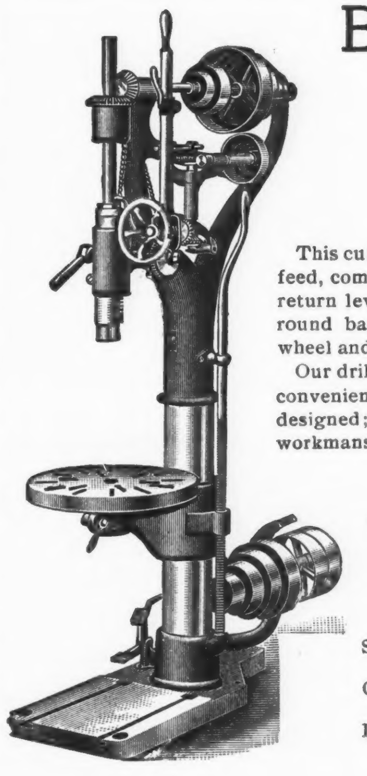

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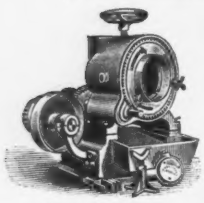

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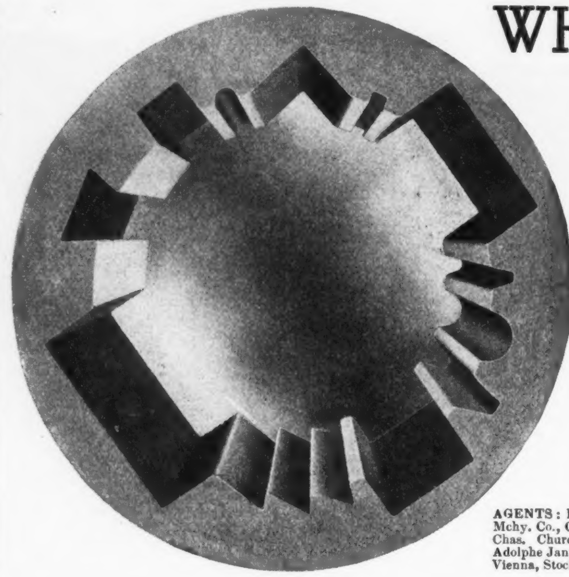

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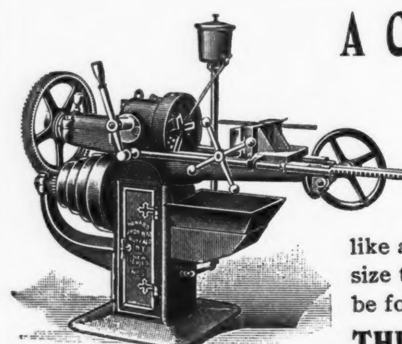

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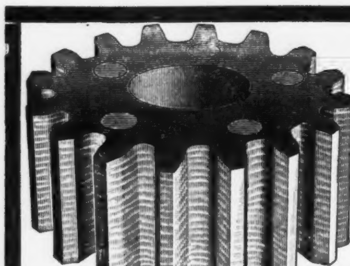

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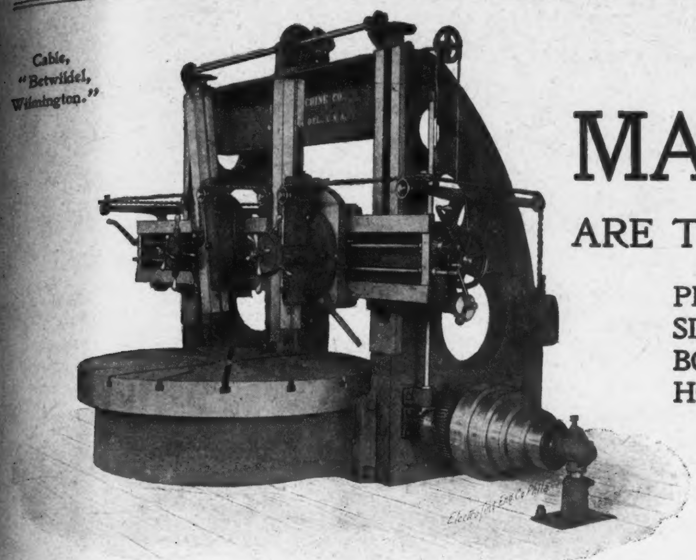

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